

MASS. EN22. a. 1582/5



**A MASSACHUSETTS
MERRIMACK RIVER WATER SUPPLY
PROTECTION INITIATIVE
1990**

GOVERNMENT DOCUMENT
COLLECTION
SEP 27 1990
UNIVERSITY OF MASSACHUSETTS
EXPOSITORY COPY

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
JOHN P. DEVILLARS, SECRETARY

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DANIEL S. GREENBAUM, COMMISSIONER

DIVISION OF WATER POLLUTION CONTROL
BRIAN DONAHOE, DEPUTY DIRECTOR

NOTICE OF AVAILABILITY

LIMITED COPIES OF THIS REPORT ARE AVAILABLE AT NO COST BY WRITTEN REQUEST TO:

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
TECHNICAL SERVICES BRANCH
WESTVIEW BUILDING, LYMAN SCHOOL GROUNDS
WESTBOROUGH, MA 01581

Furthermore, at the time of first printing, eight (8) copies of each report published by this office are submitted to the State Library at the State House in Boston; these copies are subsequently distributed as follows:

- * On shelf; retained at the State Library (two copies);
- * microfilmed; retained at the State Library;
- * delivered to the Boston Public Library at Copley Square;
- * delivered to the Worcester Public Library;
- * delivered to the Springfield Public Library;
- * delivered to the University Library at UMass, Amherst;
- * delivered to the Library of Congress in Washington, D.C.;

Moreover, this wide circulation is augmented by inter-library loans from the above-listed libraries. For example, a resident of Winchendon can apply at the local library for loan of the Worcester Public Library's copy of any DWPC/TSB report.

A complete list of reports published since 1963 is updated annually and printed in July. This report, entitled "Publications of the Technical Services Branch, 1963-(current year)", is also available by writing to the TSB office in Westborough.

A MASSACHUSETTS MERRIMACK RIVER WATER SUPPLY

PROTECTION INITIATIVE

1990

Prepared by:

Nora E. Hanley
Environmental Engineer

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
JOHN P. DEVILLARS, SECRETARY

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DANIEL S. GREENBAUM, COMMISSIONER

DIVISION OF WATER POLLUTION CONTROL
ARLEEN O'DONNELL, ACTING DIRECTOR

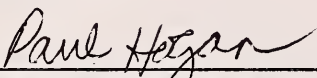
TITLE: A Massachusetts Merrimack River Protection Initiative - 1990

DATE: 4-20-90

AUTHOR(S): Nora E. Hanley, Environmental Engineer

REVIEWED BY:

APPROVED BY:



Paul Hogan, Basin Planning Supervisor



Alan N. Cooperman, Technical Services
Branch Supervisor

NH/cal
NH490-1

TABLE OF CONTENTS

<u>ITEM</u>	<u>PAGE</u>
Foreword	6
Acknowledgments	7
List of Tables	8
List of Figures	9
 I. Introduction	 10
II. Summary and Recommendations	11
III. Physical Description of the Merrimack River Watershed	21
IV. Water Supply Information	25
A. Introduction	25
B. Drinking Water Treatment Systems	25
C. Water Supply Standards and Testing	28
D. Testing Results	28
E. Water Supply Protection Shortfalls	29
V. River Water Quality	33
A. Introduction	33
B. Water Quality Standards	33
C. Existing Water Quality	35
1. Bacteria	35
2. Dissolved Oxygen	35
3. Nutrients	35
4. Toxics	38
a. Water Column	38
b. Sediment	39
c. Fish and Shellfish	39
D. Monitoring	39
1. DEP-TSB	39
2. Water Treatment Plants	40
3. Wastewater Treatment Plants	40

TABLE OF CONTENTS (continued)

<u>ITEM</u>	<u>PAGE</u>
VI. NPDES Wastewater Treatment Plant Discharges	42
A. Introduction	42
B. NPDES Inventory and Ranking	42
C. Significant Discharges	47
1. Lowell WWTP	47
2. Greater Lawrence WWTP	48
3. Nashua, NH WWTP	49
4. AT&T WWTP	49
5. W.R. Grace WWTP	49
D. Pretreatment	50
1. Regulatory Approach	50
2. Pretreatment Monitoring	53
3. Conclusion	53
E. Toxicity Testing	53
VII. Combined Sewer Overflows (CSOs)	55
A. Introduction	55
B. Significant Massachusetts Discharges	55
1. Lowell	55
2. Lawrence	57
3. Haverhill	57
VIII. Nonpoint Source Considerations	58
A. Introduction	58
B. Urban Runoff	58
IX. Solid Waste	59
X. Hazardous Waste	61
A. Introduction	61
B. Spills: Emergency Response Activities	61
C. Site Assessment and Clean up Activities	63
D. Resource Conservation and Recovery Activities	64
XI. References	66

TABLE OF CONTENTS (continued)

<u>ITEM</u>	<u>PAGE</u>
<u>APPENDICES</u>	
A. Capital Costs - Merrimack River Pollution Abatement and Water Treatment Projects	68
Table A-1: Approximate Municipal Pollution Abatement Costs	68
Table A-2: Approximate Water Supply Treatment System Costs	69
B. Geographic Information System	70
Figure: B-1 GIS Generated Water Supplies and NPDES Permits	71
Figure: B-2 GIS Generated Water Supplies and Combined Sewer Overflows	72
Figure: B-3 GIS Generated Water Supplies, TSB Sampling Stations, NPDES Permits, CSOs	73
Figure: B-4 GIS Generated Water Supplies and Hazardous Waste Sites	74
C. Massachusetts Water Quality Standards	75
D. NPDES Permit Listing - Merrimack River System	82
E. Toxicity Testing Information	85
Table E-1: Merrimack River Discharges-Toxicity Assessment	86
Table E-2: Merrimack River Discharges-Toxicity Testing Information	87
F. Combined Sewer Overflows	88
Table F-1: Lowell Combined Sewer Overflow Structures	88
Table F-2: Lawrence Combined Sewer Overflow Structures	89
Table F-3: Haverhill Combined Sewer Overflow Structures	90
G. Solid Waste Site Narrative	91
H. Hazardous Waste Site Status - Priority 1 Sites	102
I. RCRA Information and Merrimack Basin Inspections Performed	104

FOREWORD

The Massachusetts Division of Water Pollution Control was established by the Massachusetts Clean Water Act, Chapter 21 of the General Laws as amended by Chapter 685 of the Acts of 1966. Included in the duties and responsibilities of the Division is the periodic examination of the water quality of various coastal waters, rivers, streams, and ponds of the Commonwealth, as stated in Section 27, Paragraph 5 of the Acts. This section further directs the Division to publish the results of such examination together with the standards of water quality established for the various waters. The Technical Services Branch of the Division of Water Pollution Control has, among its responsibilities, the execution of this directive. This report is published under the Authority of the Acts and is among a continuing series of reports issued by the Division presenting water quality data and analyses, water quality management plans, baseline and intensive limnological studies and various special studies.

ACKNOWLEDGMENTS

I gratefully extend thanks to the following groups and individuals who helped in preparation of this report.

- The staff of the DEP Northeast Regional Office under the direction of Edward Kunce, Regional Director.
 - Jack Mullins, who coordinated the NERO effort
 - Kellie O'Keefe, from the Division of Water Supply
 - Dave Erekson and Bill Cashins from the Division of Water Pollution Control
 - John Fitzgerald from the Division of Hazardous Waste
 - Dave Adams, from the Division of Solid Waste
 - Peg Carson, from Hazardous Waste Management
 - Mary Bester-Colby, from Emergency Response
- Joe Dorant, from DWPC, Boston
- The chemists and operators of the Lowell, Tewksbury, Andover, Methuen and Lawrence Water Treatment Plants
- Paul Hogan, of TSB, for his guidance throughout
- Laurie Kennedy, of TSB, for toxicity testing information
- Claire Lombardi, for typing the report

LIST OF TABLES

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Merrimack River Water Supply Data -1989	26
2	Maximum Contaminant Levels (MCL) and Monitoring Requirements, Merrimack River - Finished Water	30
3	Merrimack River System Major NPDES Discharges	43
4	Merrimack River System Major Municipal NPDES Discharges	45
5	Merrimack River System Major Industrial NPDES Discharges	46
6	Merrimack Basin Pretreatment Communities	52
7	Upper Merrimack River Oil/Hazardous Substance Spills	62
8	RCRA Inspections Performed - Merrimack River Initiative	65

LIST OF FIGURES

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Merrimack River Basin Classification Map	20
2	Merrimack River Profile	22
3	Cumulative Travel Time vs. River Miles	23
4	Merrimack River Survey - Location of Sampling Stations	34
5	Merrimack River Dissolved Oxygen - 1986, 1989	36
6	Merrimack River Fecal Coliform Bacteria - 1989	37
7	Merrimack River Basin - Location of Major Wastewater Discharges	41
8	Schematic Diagram of a Combined Sewer System	56
9	Landfill Impacts on Ground and Surface Waters	60

I. INTRODUCTION

The Merrimack River is one of the most significant water resources in Massachusetts, and, in fact, New England. Among other important uses such as hydropower, recreation, and fishing, it is the direct water supply source for over a quarter million people in Massachusetts, second only to the Quabbin Reservoir system as a surface water source. However, unlike the Quabbin system, the Merrimack River is not protected from numerous direct wastewater discharges, nor is its watershed well protected from nonpoint pollutant sources such as urban runoff, or toxic spills.

In recognition of the Merrimack River's regional significance, the U.S. Environmental Protection Agency (EPA), the Massachusetts Department of Environmental Protection (DEP), the New Hampshire Water Supply and Pollution Control Commission (WSPCC), and the New England Interstate Water Pollution Control Commission (NEIWPCC) entered into an agreement to participate in a special initiative to address the current and future water quality issues of the Merrimack River. The Massachusetts DEP and the New Hampshire WSPCC developed their own programs to address these major issues. The Massachusetts DEP program is described below.

Since the Merrimack River's most vital use in Massachusetts is as a water supply, the DEP Bureau of Resource Protection effort, in this document, concentrated on determining the status of the river's present and likely future water quality as it impacts on water supplies. To do this we gathered water quality sampling data as well as pertinent information from the basin's wastewater discharges, landfills, combined sewer overflows, hazardous waste sites, and other problem areas. Data gathering was concentrated in the Massachusetts portion of the basin since the DEP has jurisdiction in this area, but information from New Hampshire was noted when appropriate. The Geographic Information System (GIS) was used to map the locations of sites interest in the basin. DEP also conducted interviews with chief operators and chemists at all of the Merrimack River's water treatment plants to ensure that their very relevant "frontline" information was noted.

Finally, DEP used the compiled information to create a planning document assessing, to the extent possible with present data, the relative impacts of various pollutant sources to the river. Water planning agencies can then use this information to expend limited resources on the most important pollution control areas.

"A river is more than an amenity,
it is a treasure. It offers a
necessity of life that must be
rationed among those who have
power over it."

Justice Oliver Wendell Holmes

II. SUMMARY AND RECOMMENDATIONS

The Merrimack River is one of the most significant water resources in Massachusetts, particularly since it is the water supply source for over a quarter million people in the communities of Lowell, Lawrence, Methuen, Tewksbury and Andover. In recognition of this fact, the Massachusetts DEP has concentrated particular effort on Merrimack River water quality protection issues (Water quantity issues will be addressed in a report by the Department of Environmental Management in 1995). This report analyzes existing information on the River, identifies data gaps, and prioritizes to the extent possible with existing data, the relative contributions of pollution sources to the Merrimack River which have potential impacts on water supplies.

The premise on which pollutant sources have been prioritized is based loosely on risk assessment practices, since it is impossible to obtain actual representative chemical data for every source. Where such information is available it has been incorporated into this analysis. Basically, the probability of impact to water supplies has been assessed based on estimated pollutant mass loading coupled with distance from the nearest Merrimack River water supply. In addition, in-place institutional controls and monitoring have been evaluated to ensure that current regulatory programs are adequate for water supply protection.

Using this type of assessment as a base, the DEP Bureau of Resource Protection (BRP) coordinated the efforts of a team consisting of representatives from programs in Water Supply, Water Pollution Control, Hazardous Waste, and Solid Waste in evaluating pollution sources to the Merrimack River.

One conclusion of this group effort is that direct discharges to the River, both treated (as in NPDES permittees) or untreated (as in Combined Sewer Overflows - CSOs) pose the highest potential risks to current water supplies along the Merrimack River. Most important among these are the Lowell WWTP discharge, New Hampshire sources (including the Nashua WWTP, Nashua CSOs, and the W.R. Grace Co.) and Lowell CSOs. If Haverhill begins withdrawing water from the Merrimack River, then the Greater Lawrence Sanitary District and the AT&T WWTP discharges become of increasing importance.

Next in importance to these discharges, episodic upsets, such as accidental spills are important in such a highly urban area as the Merrimack River Basin. Urban runoff and nonpoint sources impact water quality during wet weather. Many other pollution sources in the river basin, including hazardous waste sites and landfills have primary impacts to groundwater, not surface water, with some exceptions. Finally, efforts toward proper handling of the storage of hazardous substances, as emphasized in the DEP RCRA program, is good insurance against future problems, but does not directly affect river water quality.

The Merrimack River has come a long way - from the dubious distinction of being one of the nation's ten most polluted rivers in the 1960's to a present condition where obvious, noxious wastes are either treated or eliminated from discharges to the river.

To date, considerable public money has been invested in capital intensive Merrimack River projects (see Tables A-1 and A-2 in Appendix A). However, in examining current issues, it seems that a new commitment must be made toward refocusing attention on complex water issues both of a capital project scale as well as of a more subtle but equally important regulatory scale.

As a regulatory organization, the DEP, Bureau of Resource Protection has established a number of goals relative to the preservation and enhancement of the Commonwealth's water resources. The Merrimack River has been identified as a priority resource area for several reasons, primary among them, that it is a major public water supply. In addition, other important BRP goals relate to the protection of multiple-use water resources such as the Merrimack River. Finally, the BRP recognizes the importance of this Merrimack River Initiative project for the improved communication it provided both within DEP, as well as external to the agency with EPA, New Hampshire water resources authorities, Regional Planning Commissions, and the Towns.

Overall, the problem of maintenance of high quality water supplies for the Merrimack River withdrawing communities is a complex issue requiring additional resources and creative solutions. It is related to the maintenance of excellent water treatment systems, to minimization of the direct discharge of pollutants, to emergency contingency planning in the event of hazardous substance spills, to vigilance in monitoring, to watershed protection, and generally to the maintenance and improvement of instream water quality.

The following paragraphs constitute DEP's recommendations for improved water quality in the Merrimack River. For ease of use, these recommendations have been grouped according to where the activity should probably occur - at the State, Federal (EPA), local, or individual citizen level.

RECOMMENDATIONS

Federal/Interstate Activities

1. Form an interstate Merrimack River Commission to resolve issues of mutual interest on the river.
2. EPA and the NEIWPCC should continue to foster a cooperative relationship between state environmental agencies in Massachusetts and New Hampshire, whose Merrimack River resources are closely bound.
3. EPA should research and publish guidelines concerning Wastewater Treatment Plant (WWTP) effluent toxicity as it applies to human populations via drinking water supplies.

Currently, WWTP toxicity guidelines and policies are directed toward the health of aquatic organisms. In a river such as the Merrimack, the most essential use is drinking water supply. Although aquatic organisms may be more sensitive than humans to most toxins, specific human health issues deserve further attention.

4. In recognition that the quality of the Lowell water supply is intimately related to wastewater discharges in New Hampshire, particularly in Nashua and Hudson, NH, EPA, and the NH WSPCC must ensure that WWTPs located in these communities meet NPDES standards.

The Nashua WWTP, recently upgraded to secondary treatment, and the W.R. Grace Co. in Nashua, should be closely monitored for compliance with all applicable guidelines.

5. EPA and DEP Bureau of Resource Protection should strongly support any New Hampshire WSPCC efforts with the NH Legislature to upgrade the water quality classification of the Merrimack River in Nashua, NH, from Class C (appropriate for boating, fishing, industrial water supply) to Class B (appropriate for drinking water with treatment).

Although the states may define water quality classifications differently, the spirits of the classifications should be consistent across state borders and should reflect the most sensitive downstream use. The Lowell water supply, for over 100,000 people, is only six miles downstream of the NH border. Thus, the NH Merrimack River water quality planning and management classification should be recognized by the NH Legislature as Class B.

6. EPA should encourage remedial action on Merrimack River CSOs on a comprehensive basin-wide approach to CSO control, with an emphasis on CSOs impacting water supplies such as in Lowell and Nashua, NH.
7. EPA and the state of New Hampshire should approach the expansion of the Nashua, NH WWTP with caution, since the Lowell, Massachusetts water supply is close downstream.

RECOMMENDATIONS (continued)

Massachusetts Department of Environmental Protection (DEP) Activities

1. **Recognize that in the absence of a specific agency with overall jurisdiction in Merrimack River water supply issues, such as the Metropolitan District Commission (MDC) for Quabbin Reservoir issues, that the DEP Bureau of Resource Protection becomes the logical lead agency.**

The various cities and towns with Merrimack River water supplies have no jurisdiction over the maintenance of their own supply quality upstream of town boundaries. This fact points to the need for increased state involvement and coordination in this region.

The DEP Bureau of Resource Protection has designated the Merrimack River as a high priority area. Accordingly, the BRP plans to coordinate DEP involvement and to include additional resources to further Merrimack River protection.

2. **Require strict enforcement of NPDES permit limits.**
3. **Place a high priority on funding a new Lawrence Water Treatment Plant.**

The Lawrence WTP is 50 years old and in need of replacement to guarantee that Lawrence drinking water is of consistently good quality. Currently, water treatment construction grants are allocated by the DEP on a first come, first serve basis, regardless of need. The grant program funding is rapidly running out and may be replaced by a revolving loan program.

4. **The DEP Bureau of Resource Protection should develop suitable criteria to reclassify the Merrimack River upstream of Lawrence to emphasize its water supply status.**

The Merrimack River is currently classified as a Class B water - suitable for primary and secondary contact recreation, and for drinking water with treatment. A classification indicating specifically that a river is a water supply and differentiating it from other Class B rivers, is a protective measure. Classification indicating water supply status will ensure that water quality planners, both governmental and commercial, will have no doubt as to the primary use of a downstream segment.

5. **Initiate a program of raw water sampling by the river's water supplies on at least a monthly basis and more often during summer low flows and rainy weather. Include at least all parameters from the Safe Drinking Water Act.**

Considering the number of direct and indirect discharges upstream of the water supplies, increased testing of raw water seems justified. EPA, in its latest sanitary surveys at the Lowell and Lawrence water supplies (Reilly, 1988), also advocated monthly raw water testing of this magnitude.

In addition, the results should be tabulated and reported to DEP/BRP at a regular interval.

6. **Recognize in the Construction Grants state priority funding list the prime importance of the Lowell WWTP and CSOs on river water quality in the vicinity of four major water supplies. Continue funding toward improvements known to be currently needed, and on studies aimed toward process or system**

RECOMMENDATIONS (continued)

improvements, particularly in regard to CSOs, WWTP overloading, inflow and infiltration, and regular sewer system and regulator maintenance programs.

The Lowell WWTP and CSOs are upstream of the Tewksbury, Andover, Methuen, and Lawrence water supply intakes. Undoubtedly, the protection of these supplies should be a DEP priority.

The consulting firm, Camp Dresser and McKee, Inc., is in the process of completing a study on Lowell CSOs, sewer system infiltration and inflow, and water quality mathematical modelling. Pending results of this work, plans should be underway to fund the necessary improvements.

7. Initiate compliance monitoring of WWTPs, particularly those directly upstream of water supplies.

Although WWTP self-monitoring results are invaluable, indications of a WWTP's performance spot checks by the DEP would be prudent.

In addition, the chemical analysis of a more concentrated sample, such as an effluent, as opposed to a dilute sample, such as raw water from a drinking water intake, is more likely to yield accurate information concerning pollutant inputs to the river.

8. Continue a strong program of river water quality monitoring by DEP Bureau of Resource Protection.

- A. Particular attention should be paid to WWTP effluents, heavy metals, synthetic organics, and effluent toxicity control.
- B. Monitor the Merrimack River during the summer of 1990 to determine the effects of the major upgrading of the Nashua, NH WWTP.
- C. Start a program of wet weather and seasonal testing.
- D. Start a DEP/BRP database of Water Treatment Plant influent vs. effluent data.
- E. Investigate latitudinal water quality variations and mixing questions on the Merrimack River.

9. Evaluate the Lowell WWTP for process optimization by the DEP Technical Assistance Section, in view of the WWTP's importance to downstream water supplies.

Despite great strides in recent years and good adherence to its Consent Decree schedules, the Lowell WWTP may still have problems in handling higher than normal flows. Studies by the city's consultant, CDM, indicate that the WWTP is performing optimally. A confirmation of this would be appropriate.

10. Strengthen the DEP Pretreatment Program, particularly in relation to Merrimack River basin pretreatment programs.

- A. Include adequate resources within DEP to monitor local pretreatment programs, including adequate regional staff. Coordinate DEP Bureau of Waste Prevention and Bureau of Resource Protection Activities.

RECOMMENDATIONS (continued)

- B. Emphasize waste minimization and source reduction.
- C. Local limits for pretreatment communities should be reexamined and recalculated, if necessary, according to the latest EPA guidelines.
- D. Identify and institute occasional spot checks of major Merrimack Basin pretreatment industries and include chemical effluent sampling.
- E. Reevaluate non-pretreatment communities in the Merrimack Basin for possible pretreatment status.

Metals levels, particularly lead, mercury, and copper were, at times, above water quality standards during 1986 and 1989 DEP sampling downstream of Lowell. Although the source of the metals was not identified, one likely controllable source is industrial inputs to municipal WWTPs. Pretreatment program operation is the responsibility of the individual WWTP. However, DEP and EPA guidance and support is important.

- 11. Require an improvement in water treatment plant (WTP) contingency plans including a formalized emergency network between the WTPs, and upstream WWTPS (including those in New Hampshire).
- 12. Catalog and inspect bulk petroleum and chemical storage tanks on the mainstem and tributaries. Review spill containment/control plans.
- 13. Fund and encourage frequent community household hazardous waste pick-ups.
- 14. Fund and encourage local curbside recycling of domestic wastes.
- 15. Complete a literature search concerning water supply protection in other multi-use rivers.

If the information is applicable to Merrimack River issues, direct DEP Bureau of Resource Protection activities toward innovative programs.

- 16. Simplify DEP electronic data retrieval by river basin by the addition of a field indicating river basin in Departmental databases.

Computerized databases at the Technical Services Branch are all organized by river basin, as are NPDES permits and other EPA data. However, other databases in the Department do not have this type of organization. If river basin protection is to receive future attention by the Department, it would be helpful to begin to add a new field to current databases. In this way searching for information is simplified.

- 17. Encourage the Department of Environmental Management to begin work on its Merrimack River water quantity planning effort prior to its currently scheduled 1995 date.
- 18. Work with the Massachusetts Department of Public Works to eliminate or control runoff from the salt storage pile on a Merrimack tributary upstream of the Methuen WTP.

RECOMMENDATIONS (continued)

Local Activities

1. **Initiate water conservation.** Residential water conservation can be encouraged through community education programs in the region. Devices such as low-flow shower heads, toilet dams, and faucet aerators have been shown to reduce residential water use significantly and should be encouraged. Economic incentives such as a graduated water rate scale can be introduced.

Water conservation has many obvious benefits, among them reduced water and wastewater treatment costs. For example, the Lowell WWTP is fast approaching design capacity. Water conservation is one way to forestall the expensive facilities planning process which is triggered via NPDES permitting when a WWTP reaches 80 percent capacity for 90 consecutive days.

2. **Implement Best Management Practices to control urban runoff, including street sweeping and catch basin cleaning programs.**

Best management practices are relatively low-cost, nonstructural alternatives for the control of runoff and overflows. They have been found to be cost effective for the control of pollutants.

3. **Enforce Pretreatment Standards**

The enforcement of pretreatment standards for industrial waste entering municipal sewer systems is the responsibility of the individual wastewater plants. Inadequately treated industrial waste could cause the municipal WWTPs to have operational upsets, or to pass pollutants through their processes without adequate treatment. Metals levels in the Merrimack River have exceeded water quality criteria in past sampling.

4. **Ensure that WTPs and WWTPs have adequate operation and maintenance budgets, and that plant personnel have competitive salaries and necessary training.**

It should be acknowledged and publicized within the towns, that modern WTPs and WWTPs are complex utilities requiring skillful upkeep and a well-trained staff.

5. **Communities with Combined Sewer Overflows (CSOs) such as Lowell, Lawrence, Haverhill, and Nashua, NH, should develop regular maintenance programs for their sewer systems.**

Studies on the Connecticut River have shown that sewer maintenance, such as unblocking pipes and repairing broken regulators, can be a most economically attractive alternative for controlling CSO discharges.

6. **Formalize an emergency communication network between water treatment plants and known upstream discharges.**

7. **Minimize winter road salt use where possible.**

8. **WWTP pretreatment coordinators are encouraged to join or form a pretreatment network such as that formed by coordinators on the North Shore.**

RECOMMENDATIONS (continued)

9. Water treatment plant chief operators, chemists, and management are encouraged to form an organization to exchange information on Merrimack River topics.
10. Water treatment plant chemists on the "frontline" as far as knowledge of Merrimack River quality, are encouraged to keep in touch with DEP personnel and to do their own raw water, wet-weather (or other) investigations.

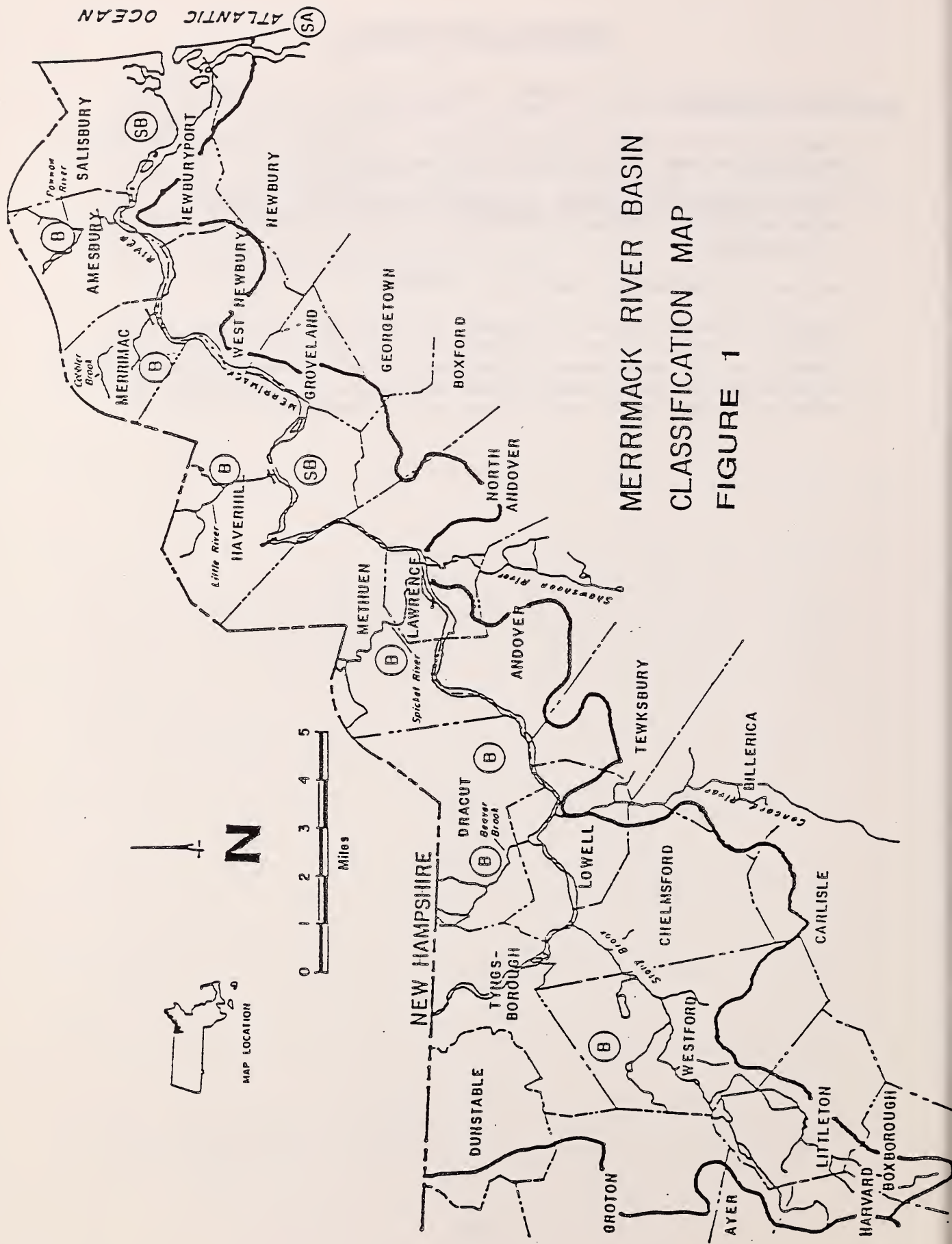
Fecal coliform and metals information would be of particular value to identify upstream problem sources.

RECOMMENDATIONS (continued)

Individual Activities

1. Join the Merrimack River Watershed Council, a citizen's organization devoted to the improvement of conditions on the Merrimack River.
2. Work with state environmental officials, and municipal elected representatives to encourage that prompt actions be taken on issues presented in this report.
3. Use non-toxic household chemicals in the home.

Household chemicals which are disposed of in a sewer system will end up treated, or untreated, in a river or coastal water. Massachusetts Audubon, Lincoln, and the Massachusetts Department of Environmental Management, Bureau of Solid Waste Disposal, Boston, have information available concerning detergents, fertilizers, and alternatives for household chemicals.



MERRIMACK RIVER BASIN
CLASSIFICATION MAP
FIGURE 1

III. PHYSICAL DESCRIPTION OF THE MERRIMACK RIVER WATERSHED

The Merrimack River drainage basin, fourth largest in New England, has a total of 5,010 square miles in New Hampshire and Massachusetts combined, with 24 percent or 1,200 square miles in Massachusetts. The river's mainstem is formed in central New Hampshire by the confluence of the Pemigewasset and Winnepesaukee rivers. It flows southward through central New Hampshire for 78 miles and into Massachusetts. Once in Massachusetts it continues generally southeast for about six miles before turning to the northeast, near the city of Lowell. From there, the Merrimack flows the remaining 44 miles to the city of Newburyport where it discharges into the Atlantic Ocean.

The majority of the Merrimack River Basin's topography consists of moderate to rolling terrain. Bounding this central area are the basins's extremes - the mountainous terrain at the northern headwaters, and the coastal plain at the river's terminus.

From the Massachusetts state line to the river's mouth, a distance of 50 miles, the Merrimack drops 90 feet in elevation, as illustrated in Figure 2. Part of this elevation drop includes flow over two major dams in Lawrence and Lowell, Massachusetts. Major canal systems diverting the river flow are also present in Lawrence and Lowell.

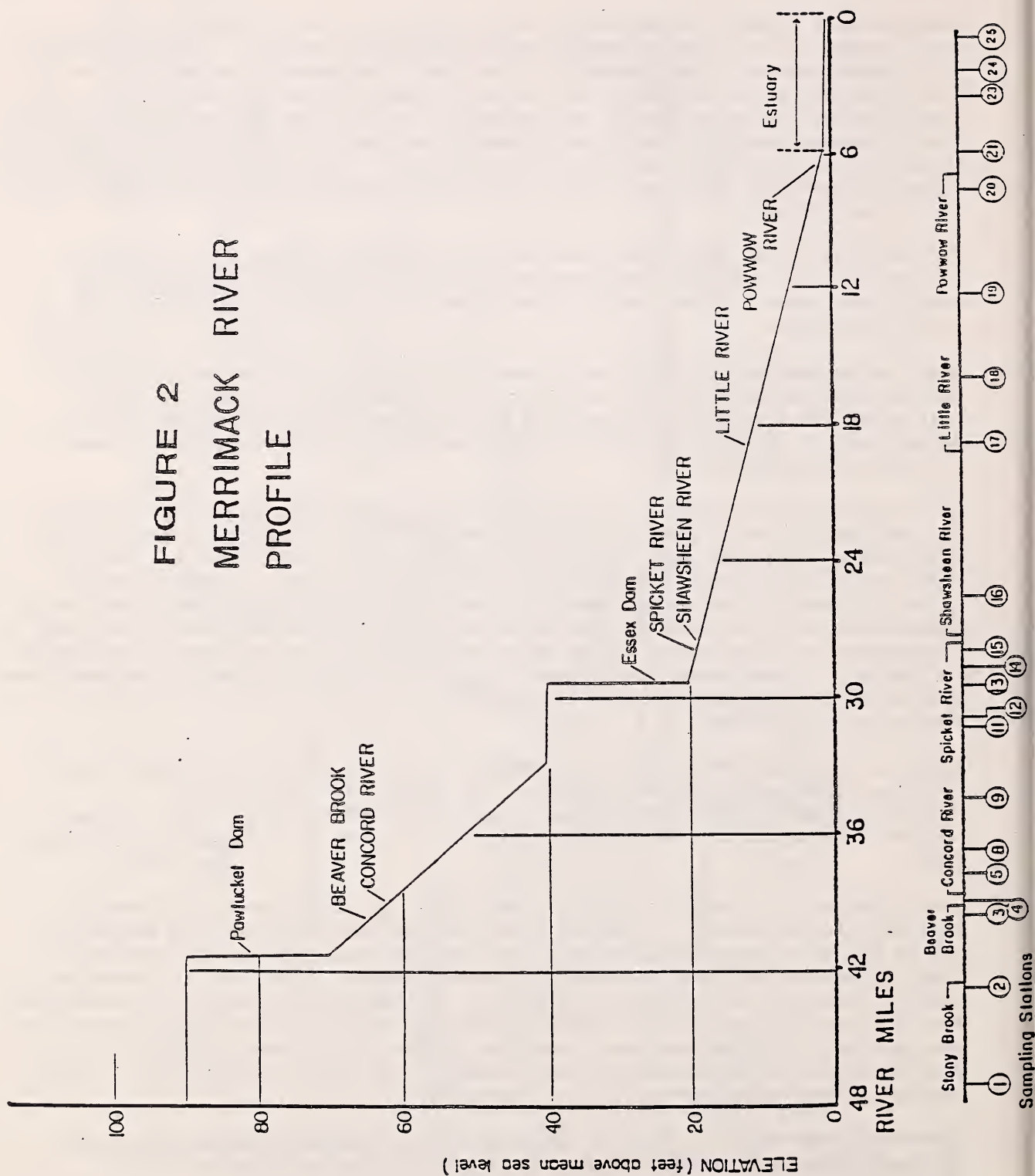
The United States Geological Survey (USGS) maintains a flow monitoring station on the Merrimack River in Lowell, below the Concord River confluence. The average discharge at this gage over 55 years of record is 7,474 cubic feet per second (cfs) and the seven-day, ten-year low flow is about 930 cfs. Stream time-of-travel information was investigated in 1966 by the Federal Water Pollution Control Administration.* The studies were conducted using a Rhodamine B dye tracer and fluorometer on the mainstem and selected tributaries. The information is plotted in Figure 3. These plots are extremely useful for predicting the approximate time a pollutant would take to travel a particular section of the river during a particular flow regime.

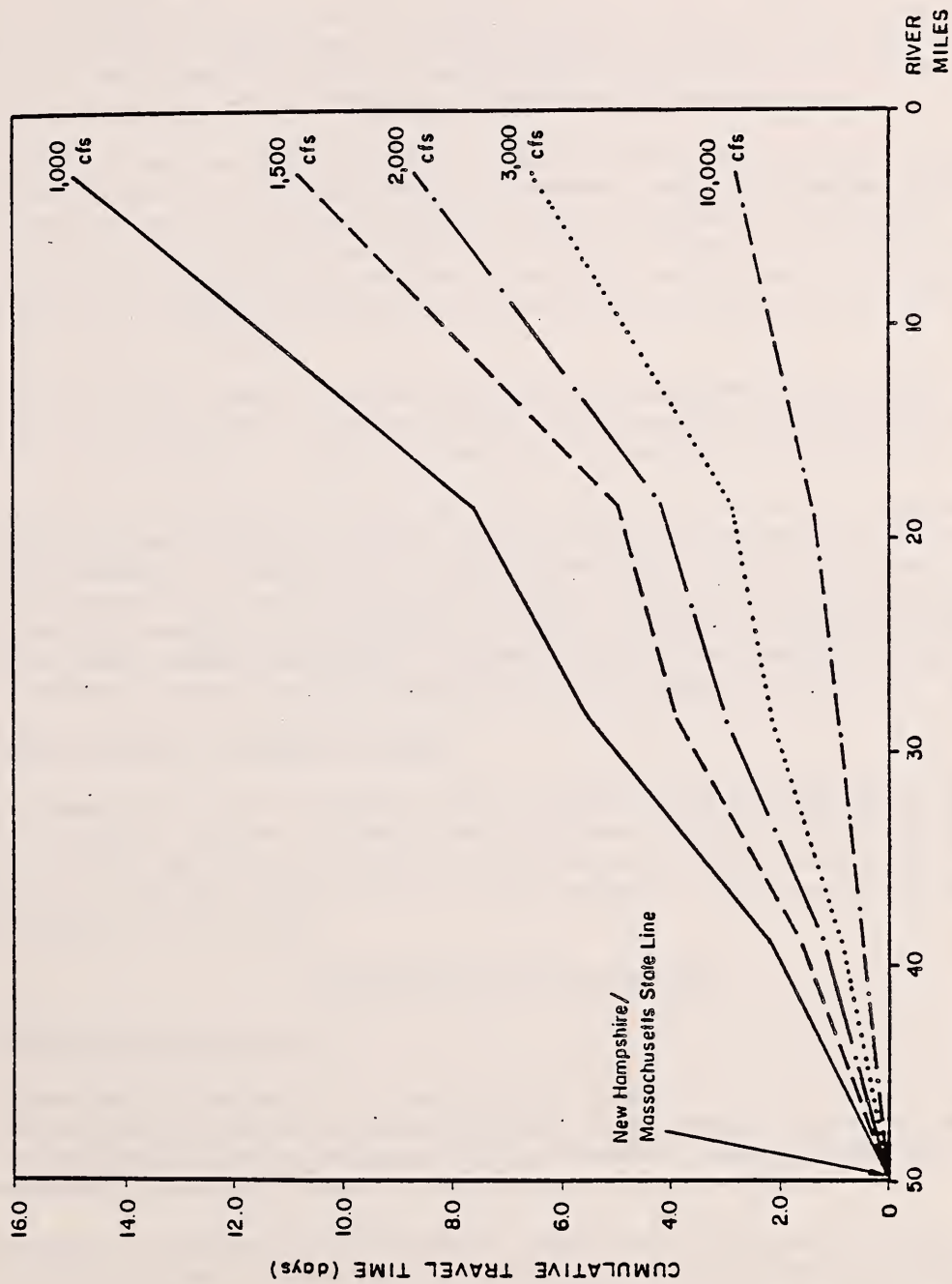
Important subwatersheds within the Massachusetts portion of the Merrimack River drainage basin are the Nashua (530 sq. mi.), Stony Brook (51 sq. mi.), Sudbury/Assabet/Concord (406 sq. mi.), and the Shawsheen (72 sq. mi.). Other smaller tributaries include Beaver Brook, Spicket River, Little River, and Powwow River.

The three major cities along the Merrimack River in Massachusetts are Lowell, Lawrence, and Haverhill. These old industrial centers were once the sources of severe pollution from untreated municipal and industrial wastewater discharges. Today, however, secondary wastewater treatment plants (WWTPs) are in operation in Lowell, Lawrence, and Haverhill, as well as in Amesbury, Merrimac, and Newburyport and Salisbury. Water quality problems are still evident in the basin due to other sources including combined sewer overflows in Lowell, Lawrence, and Haverhill, smaller untreated discharges, nonpoint sources, and highly significant pollutant sources in New Hampshire such as the Nashua WWTP.

*Federal Water Pollution Control Administrations. Report on Pollution of the Merrimack River and Certain Tributaries - Part II - Stream Studies. 1966.

FIGURE 2
MERRIMACK RIVER
PROFILE





Adapted from: FWPCA, 1966

DEQE-DWPC-Technical Services Branch

MERRIMACK RIVER BASIN

CUMULATIVE TRAVEL TIME VS. RIVER MILES

FIGURE 3

Over 4,000 acres of salt marsh drain into the Merrimack River estuary. Its maximum length is nine (9) miles, its maximum width is 0.8 miles, its mean high water area is about 4,000 acres and its mean low water area is about 2,000 acres. The estuary is relatively shallow, a factor which contributes to its high flushing rate (56%) and high productivity. At low tide about 90 percent of the estuary area is less than 18 feet deep, and about 50 percent of the area is less than five feet deep.

IV. PUBLIC WATER SUPPLY INFORMATION

A. Introduction

The Merrimack River is the direct water supply source for over a quarter million people in Massachusetts. The river supplies an average of approximately 40 million gallons per day of water to the water treatment plants in Lowell, Tewksbury, Andover, Methuen, and Lawrence. Other towns and cities along the river, e.g., North Andover, Dracut, and Haverhill, are also considering the possibility of direct water withdrawal from the Merrimack River.

The Merrimack River, as a surface water supply source, is second in volume to the Greater Boston Quabbin Reservoir system. However, unlike the Quabbin Reservoir, the Merrimack River is not protected from direct wastewater discharges, nor is its watershed protected from nonpoint sources, such as urban runoff, upstream of its water supplies. Wastewater discharges to the Merrimack River are discussed in the chapter entitled "NPDES Discharges," and nonpoint pollutant sources are discussed under that general heading.

The Merrimack River presents unique water quality management challenges because of its use as a water supply. Maintenance and improvement of water quality in this river will have direct and positive impacts on surrounding communities.

It is essential, in order to ensure reliable, high quality water supplies, that the source of these supplies, the Merrimack River, be protected to as great an extent as possible. In addition to source protection, any drinking water protection scheme will necessarily include water treatment and chemical and microbiological testing. The remainder of this chapter will discuss the facts relevant to water supply protection and monitoring - the specific Merrimack River water treatment systems, testing regulations, and testing results.

B. Drinking Water Treatment Systems

The five communities which withdraw water directly from the Merrimack River, Lowell, Tewksbury, Andover, Methuen, and Lawrence, all have full water treatment facilities. The facilities, with the exception of Lawrence, are relatively new. Table 1 lists relevant information for each community. The following paragraphs further describe each system.

Treatment System Descriptions

Andover Water Department

Conventional Treatment Plant at Haggetts Pond

- Fish Brook is pumped to Haggetts Pond. Supplemental water is pumped from the Merrimack River to Haggetts Pond as needed. The estimated amount of Merrimack River water used in the Andover system is 58%.

Treatment includes: Predisinfection, Rapid mix, Flocculation, Sedimentation, Gas Chlorination, Filtration (GAC), Aluminum Sulfate, Potassium Hydroxide, Hydrofluorosilicic Acid, and Sodium Hypochlorite, Powdered Activated Carbon (PAC) when needed.

TABLE 1

MERRIMACK RIVER WATER SUPPLY DATA¹

1989

	SERVICE POPULATION	AVERAGE DAY-DEMAND (MGD) ³	MAXIMUM DAY-DEMAND (MGD)	AGE OF TREATMENT PLANT ² (YEARS)
Lowell	>100,000	16.3	24	9
Tewksbury	27,000	2.42	4.63	1
Andover	28,000	5.14	11.57	1
Methuen	38,000	4.9	8.54	7
Lawrence	60,000	8.84	14.5	50
TOTAL	>253,000	37.60	63.24	--

¹ Data provided by the Massachusetts Department of Environmental Protection, Division of Water Supply. The data are approximate.

² If major modifications have occurred at a treatment plant, age is determined at the time of modification completion.

³ MGD - million gallons per day.

Contingency plan: The town pumps water from the Merrimack River into Haggetts Pond, and then into the treatment plant. Without water from the river Andover has a water supply of over six months. Thus, if Haggetts Pond purity is maintained, Andover has a more than adequate contingency plan.

Lawrence Water Department

Filter Plant at Merrimack River

Treatment includes: Slow mechanical mix, Coagulation/Flocculation, Sedimentation, GAC Filtration, Gas Chlorination, (Pre and Post), Alum, Lime, Sodium Silicofluoride.

Other Information: The system is 50 years old and needs replacement. The city will begin a pilot plant testing program in preparation for a new water treatment plant. The storage reservoir, also, needs immediate maintenance.

Contingency plan: The city would shut down its water intake and use its storage reservoir (the storage reservoir has a capacity of 44 million gallons - enough for three to four days). Lawrence is also connected to Andover, North Andover, and Methuen (these are small connections only - the storage reservoir is the major emergency supply). Contingency measures in Lawrence may be adequate when the storage reservoir is upgraded. (The city is under DEP order to cover the reservoir).

Lowell Water Department

Conventional Treatment Plant at Merrimack River

Treatment includes: Rapid Mix (Baffles), Coagulation/Flocculation, Sedimentation, Sand and GAC Filtration, Gas Chlorination (Pre and Post), Lime, Alum, Hydrofluorosilicic Acid, and Sodium Hydroxide.

Contingency plan: Lowell has a five and one-half million gallon covered reservoir which can be used. The city also has small interconnections to Tewksbury and Dracut. Contingency plans in Lowell do not seem adequate.

Methuen Water Department

Conventional Treatment Plant at Merrimack River

Treatment includes: Rapid Mix, Coagulation/Flocculation, Sedimentation, Rapid Filtration (GAC), Chlorine Dioxide (Pre), Hypochlorite (Post), Aluminum Sulfate, Phosphate - Calgon TG-10, Potassium Hydroxide, (PAC - as needed).

Contingency plan: The town has approximately 7.4 million gallons in storage. The town also has emergency, unmetered tie-in to Haverhill, Salem, NH, and Lawrence.

Tewksbury Water Treatment Plant

Conventional Treatment Plant at Merrimack River

Treatment includes: Rapid Mix, Coagulation/Flocculation, Sedimentation, Sand and GAC Filtration, Chlorine Dioxide (Pre), Hypochlorite, Alum, Potassium Hydroxide, Hydrofluorosilicic Acid and Sodium Fluoride, (PAC - as needed).

Contingency plan: The town has six active wells and also has metered tie-ins with Lowell, Andover, and Billerica.

C. Water Supply Standards and Testing

Testing of drinking water is done on either "raw" water, i.e., water directly from the Merrimack River, or "finished" water, i.e., water which has gone through the treatment process. Most federal and state drinking water testing regulations apply to "finished" water. The 1986 amended Safe Drinking Water Act regulations apply mainly to "finished" water. Drinking water suppliers, are required to test their "finished" or treated water in accordance with both EPA Safe Drinking Water Act and Massachusetts Department of Environmental Protection (DEP) requirements and to report this information to DEP. Table 2 lists applicable limits for public water supply systems.

In addition to legally mandated testing, the DEP Lawrence Experiment Station (LES) performs one annual analysis on raw and finished water for conventional parameters such as turbidity, nutrients, sodium, lead, and iron. Inorganic chemicals (heavy metals) were tested for once every three years by LES on finished water, but this program has been recently discontinued.

The water suppliers check raw and finished water for numerous conventional parameters for process control and quality maintenance purposes on a daily to monthly basis.

The only "raw" water parameter regularly reported to DEP is total coliform bacteria. Although not required by law, voluntary compliance with this testing is an accepted practice.

D. Drinking Water Testing Results

According to water supply engineers at the DEP Northeast Regional office, Merrimack River treated water supplies consistently meet drinking water standards. The quality of the drinking water from the Merrimack River, beyond legally mandated standards, is a complex issue. The DEP does not rate water supply quality beyond Safe Drinking Water Act standards. The quality problems which can potentially occur for the Merrimack River System, which is subject to time-varying pollutant inputs, is discussed in the next section, "Water Supply Protection Shortfalls."

E. Water Supply Protection Shortfalls

Although few drinking water supply quality standards violations have occurred with Merrimack River water supplies, this does not mean that we can relax our vigilance. Unlike reservoir and groundwater supplies, river water supplies present unique challenges due to their dynamic, time-varying natures.

The "multiple barrier concept," i.e., in a water supply system there should exist multiple obstacles to pollutant passage to the consumer, is highly relevant in the case of the Merrimack River. The concept dictates that "barriers" to pollution, such as strict discharge limits, frequent testing and watershed protection upstream of the water treatment plants are prudent measures in the protection of public health.

Much conventional chemical data are generated and accumulated, but data collected by water suppliers on heavy metals and synthetic organics is limited. Note that, as indicated in Table 2, water suppliers are only required to report metals levels to DEP once per year, which is too infrequent for DEP to detect trends. Recent evidence indicates that the Merrimack River may not be a well-mixed system, and so pollutants such as heavy metals may travel downstream as discrete slugs (see Chapter V, "River Water Quality"). Thus, more frequent testing for metals may be necessary. In addition, data gathered by the water suppliers should be correlated to rainfall, which is important in a system such as the Merrimack River, which is affected by Combined Sewer Overflows (CSOs) and urban runoff.

It should also be acknowledged that water supply testing reveals problems after the fact. Also, analytical instrumentation, no matter how sophisticated, has detection limits. Therefore, river watershed protection and discharge limitation are essential in providing high quality water supplies.

In the event of an episodic upset in raw river quality, such as that due to a hazardous substance spill, no formal communications network exists between communities. Two communities have limited in-line water storage or limited emergency supplies.

With relatively low quality water supply source such as the Merrimack River, excellent water treatment plant operations must be maintained. Lawrence's present facility is fifty years old, and in need of the upgrade which is in the planning process.

Overall, the problem of maintenance of high quality water supplies for the Merrimack River communities is a complex issue requiring creative solutions. It is related to the maintenance of excellent water treatment systems, to emergency contingency planning in the event of hazardous substance spills, to vigilance in monitoring, to minimization of the direct discharge of pollutants, to watershed protection, and generally to the maintenance and improvement of instream water quality.

TABLE 2

MAXIMUM CONTAMINANTS LEVELS (MCL) AND MONITORING REQUIREMENTS

PUBLIC WATER SYSTEMS
FINISHED WATER

CONTAMINANT	MCL (mg/l)	TESTING FREQUENCY ¹
Inorganic Chemicals:		
Arsenic	0.05	1/YR
Barium	1.0	1/YR
Cadmium	0.010	1/YR
Chromium	0.05	1/YR
Lead	0.05	1/YR
Mercury	0.002	1/YR
Selenium	0.01	1/YR
Silver	0.05	1/YR
Fluoride	1.4-2.4 ²	1/YR
Sodium	20.0	1-4/YR ³
Nitrate	10.0	1/YR
Total Coliform Bacteria (#/100 ml)	1.0 ⁴	Population Dependent
Chlorinated Hydrocarbons:		1/3 YR
Endrin	0.0002	
Lindane	0.004	
Methoxychlor	0.1	
Toxaphene	0.005	
Chlorophenoxys:		1/3 YR
2,4-D	0.1	
2,4,5-TP Silvex	0.01	
Regulated Organic Chemicals:		4/YR ⁵
Benzene	0.005	
Vinyl Chloride	0.002	
Carbon Tetrachloride	0.005	
1,2-Dichloroethane	0.005	
Trichlorethylene	0.005	
1,1-Dichlorethylene	0.007	
1,1,1-Trichlorethane	0.20	
Para-dichlorobenzene	0.075	

- ¹ Individual WTPs often test more frequently. Also, additional sampling is frequently required when threshold levels are detected.
- ² Varies by temperature
- ³ If levels exceed 15 mg/l, analyses repeated quarterly.
- ⁴ Monthly average. Soon to institute a "presence/absence" procedure.
- ⁵ Reviewed every three years.

TABLE 2 (continued)

MAXIMUM CONTAMINANTS LEVELS (MCL) AND MONITORING REQUIREMENTS

PUBLIC WATER SYSTEMS
FINISHED WATER

CONTAMINANT	MCL (mg/l)	TESTING FREQUENCY*
Non-Regulated Organic Chemicals (I)	**	1/YR
1. Chloroform		
2. Bromodichloromethane		
3. Chlorodibromomethane		
4. Bromoform		
5. Trans-1,2-Dichloroethylene		
6. Chlorobenzene		
7. m-Dichlorobenzene		
8. Dichloromethane		
9. cis-1,2-Dichloroethylene		
10. O-Dichlorobenzene		
11. Dibromomethane		
12. 1,1-Dichloropropene		
13. Tetrachloroethylene		
14. Toluene		
15. p-Xylene		
16. o-Xylene		
17. m-Xylene		
18. 1,1-Dichloroethane		
19. 1,2-Dichloropropane		
20. 1,1,2,2-Tetrachloroethane		
21. Ethylbenzene		
22. 1,3-Dichloropropane		
23. Styrene		
24. Chloromethane		
25. Bromomethane		
26. 1,2,3-Trichloropropane		
27. 1,1,1,2-Trichloroethane		
28. Chloroethane		
29. 1,1,2-Trichloroethane		
30. 2,2-Dichloropropane		
31. o-Chlorotoluene		
32. p-Chlorotoluene		
33. Bromobenzene		
34. 1,3-Dichloropropene		
35. Ethylene dibromide (EDB)		
36. 1,2-Dibromo-3-chloropropane (BDGP)		

* Individual WTPs often test more frequently. Also, additional sampling is frequently required when threshold levels are detected.

** None currently established

TABLE 2 (continued)

MAXIMUM CONTAMINANTS LEVELS (MCL) AND MONITORING REQUIREMENTS

PUBLIC WATER SYSTEMS
FINISHED WATER

CONTAMINANT	MCL (mg/l)	TESTING FREQUENCY*
Non-Regulated Organic Chemicals (II)	**	1/YR
1. 1,2,4-Trimethylbenzene		
2. 1,2,4-Trichlorobenzene		
3. 1,2,3-Trichlorobenzene		
4. n-Propylbenzene		
5. n-Butylbenzene		
6. Naphthalene		
7. Hexachlorobutadiene		
8. 1,3,5-Trimethylbenzene		
9. p-Isopropyltoluene		
10. Isopropylbenzene		
11. Tert-butylbenzene		
12. Sec-butylbenzene		
13. Fluorotrichloromethane		
14. Dichlorodifluoromethane		
15. Bromochloromethane		

* Individual WTPs often test more frequently. Also, additional sampling is frequently required when threshold levels are detected.

** None currently established

V. RIVER WATER QUALITY

A. Introduction

Accurate information on the state of the Merrimack River's water quality is a necessary component of any river protection scheme. The information can act as a general barometer of river health, is vital to the functioning of drinking water treatment plants, and can act as an indicator of pollution "hot spots".

This chapter will discuss four related topics: The standards governing the Merrimack River's water quality, the current state of water quality, major sources of pollution, and the testing which is done to determine water quality.

B. Water Quality Standards

The Massachusetts freshwater portion of the Merrimack River is classified by the Commonwealth of Massachusetts as a Class B water. Waters assigned to this class are designated for the use of "protection and propagation of fish, other aquatic life and wildlife, for primary and secondary contact recreation, and for drinking water with treatment." Class B regulations are printed in Appendix C. In addition to state numerical standards, the US EPA ambient water quality criteria are used as guidance when the Massachusetts standards are narrative rather than numerical for a particular substance. Drinking water standards generally apply to water after it is treated, and are discussed in Chapter IV.

The Merrimack River in New Hampshire, as it crosses the Massachusetts border, is classified by the State of New Hampshire as a Class C water. According to New Hampshire definitions "these are waters which are to have the third highest quality and are potentially acceptable for boating, fishing, or industrial water supply following appropriate treatment."

In examining the water quality standards for the Merrimack River, two issues become apparent. The first issue is consistency of standards across the Massachusetts/New Hampshire border. The states may define their water classes differently, however, the spirits of the water classes should be consistent across borders, with the highest designated use the controlling use. In this case the standards do not mesh and, the Lowell water supply, the most sensitive water receptor, is just six (6) miles downstream of the border.

The second issue is the Massachusetts classification of a drinking water supply. Should a water supply be flagged differently from other waters in the Commonwealth as a part of it's classification? A classification indicating that the river is a water supply is a protective measure. There will be no question as to the area's importance in future water quality planning. In addition, provisions could be built-in to the standard concerning, perhaps the need for increased monitoring, the necessity of pretreatment programs at any municipal WWTP's upstream of classified water supplies, and the prohibition of new or increased wastewater loadings or sewer connections.

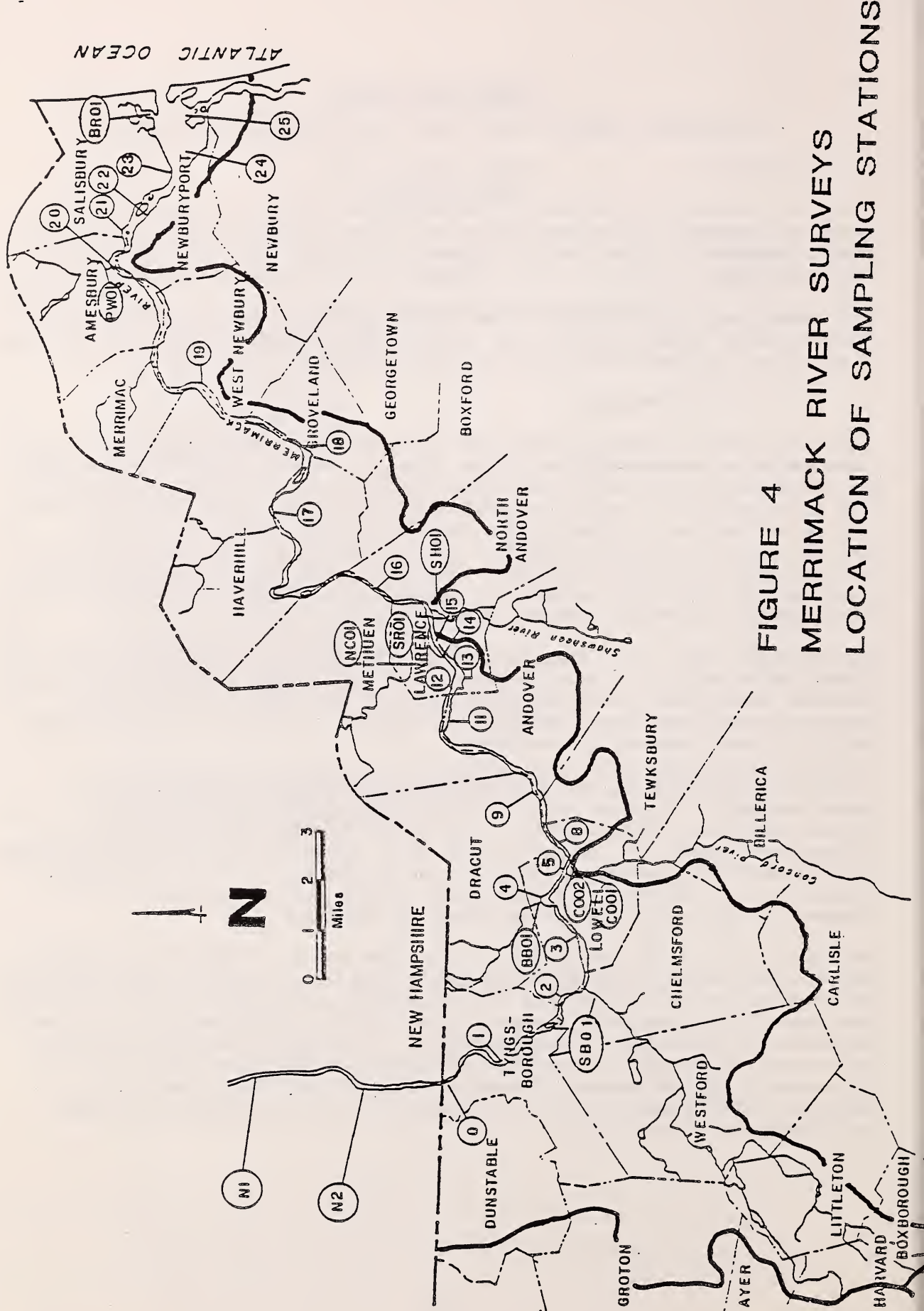


FIGURE 4
MERRIMACK RIVER SURVEYS
LOCATION OF SAMPLING STATIONS

C. Existing Water Quality

The water quality of the Merrimack River has improved greatly over the past ten years mainly due to upgrading at the Wastewater Treatment Plants (WWTPs) in the basin. However, the Merrimack River still has major water quality problems. The DEP, Technical Services Branch has conducted surveys of the Merrimack River every two to five years since 1968, with the most recent surveys in 1986 and 1989. A brief discussion of current water quality is described below, although a complete listing and analysis of 1989 TSB data will be published separately.

1. Coliform Bacteria:

Bacterial contamination continues to be a major water quality problem in the Merrimack River. The Massachusetts Class B water quality standard for the freshwater section of the Merrimack River is 200 fecal coliform per 100 ml. The river did not meet this standard during 1986 or 1989. Fecal coliform levels at most stations during surveys in June and July of 1989 were in the 800 and 2000 fecal coliform per 100 ml range respectively. The 1989 data are plotted in Figure 6. Primary causes of this bacterial contamination are New Hampshire sources, Combined Sewer Overflows (CSOs), WWTP bypasses in Lowell and tributary sources. Wet weather exacerbates the problem since the sewer systems in Nashua, NH, Lowell, Lawrence, and Haverhill are combined wastewater and stormwater systems, which overflow to the Merrimack River when their capacities are exceeded.

2. Dissolved Oxygen:

The amount of dissolved oxygen in a river is an important measure of its overall health. Dissolved oxygen in a river is depleted by the decomposition of organic matter such as that contained in sewage. Sources of dissolved oxygen to a river include atmospheric aeration and instream algal photosynthesis. A river needs to maintain an adequate dissolved oxygen level instream to maintain the health of fish and other aquatic organisms, as well as to avoid nuisance conditions such as odor problems.

The Massachusetts Class B water quality standard for the freshwater portion of the Merrimack River is a minimum of 5 mg/l. Measurements of dissolved oxygen during surveys of the Merrimack River during 1989 (and, in fact, as far back as 1981) meet or exceed the standard. The 1986 and 1989 data are plotted in Figure 5. Since samples were taken during the summer season, when oxygen solubility is low, we can extrapolate these data to mean that the Merrimack River meets its oxygen standards in general.

3. Nutrients:

Nutrients are substances essential to an organism's growth or reproduction. Aquatic organisms such as algae and macrophytes depend on dissolved nitrogen and phosphorus compounds as nutrients. However, excessive amounts of nutrients can lead to nuisance algae "blooms," which can inhibit uses of the stream. In addition, ammonia, the initial by-product of organic nitrogen decomposition, can exert a strong oxygen demand, and, in its unionized form, is toxic to aquatic life. The

Figure 5
Merrimack River Dissolved Oxygen

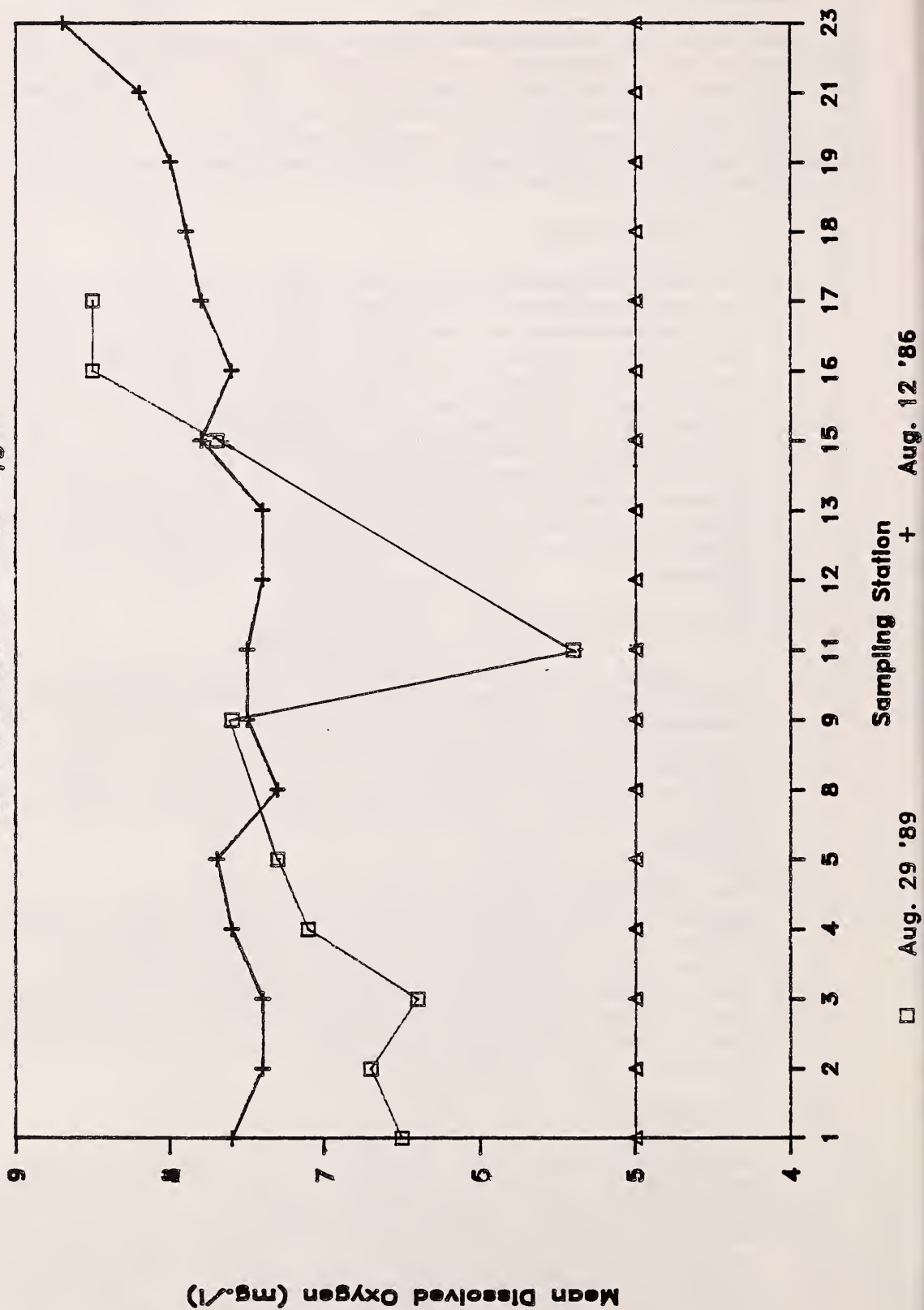
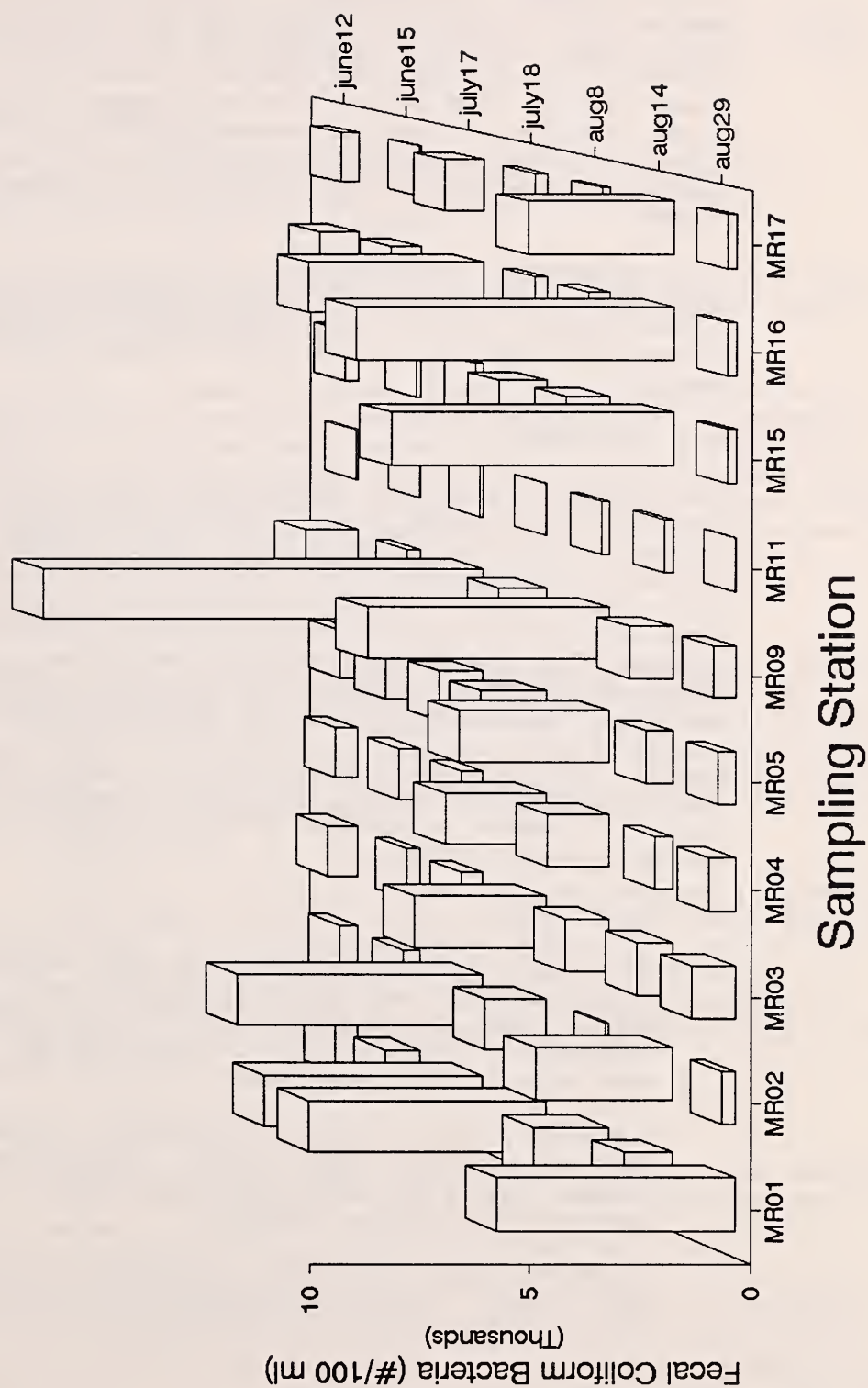


Figure 6
Merrimack River
Fecal Coliform Bacteria - 1989



presence of nutrients in excessive levels can serve as indicators of point and nonpoint sources of pollution.

Ammonia-nitrogen concentrations in the Merrimack River are not at toxic levels, but are somewhat high relative to "unpolluted" streams in Massachusetts. Similarly, nitrate, the end product of ammonia oxidation, and phosphorus are present in levels indicative of nutrient loading sources. The primary origins of ammonia-nitrate and phosphorus in the river are municipal wastewater effluents, and an industrial source, W.R. Grace, which is located just a few miles from the Massachusetts border, but which has recently upgraded its treatment process.

Since the Merrimack River channel is deep, flow velocities rapid, and banks steep, there is relatively little opportunity for the growth of nuisance aquatic plants. Thus, the hydraulics of the Merrimack prevent eutrophication problems, despite the fact that sufficient nutrients are available.

4. Toxic Pollutants

The term "toxic pollutants" encompasses a wide range of literally thousands of substances ranging from heavy metals to synthetic organic compounds. Very low concentrations of some of these substances, including concentrations at or below analytic instrument capabilities, can be toxic. Thus, it becomes important not to rely solely on instream data, where dilution effects come into play. Identification and sampling of sources of this pollution, as well as, areas where toxic substances may be more concentrated, such as biological organisms and sediments, become valuable tools to supplement instream toxics data.

Overall, to date, levels of lead, mercury, copper and zinc have been detected by DEP/TSB instream, at places, in excess of EPA water quality criteria. However, we have not detected synthetic organics instream during screening studies.

a. Water Column

Heavy metals were tested for in-the-water column during DEP/TSB water quality surveys in 1981, 1986, and 1989. During 1986, and again in 1989, levels of lead, mercury, and copper exceeded the EPA recommended instream criteria at some stations. However, levels were below drinking water standards, which are less stringent.

A screening study of acid and base/neutral extractable organics was conducted during the 1989 surveys. Five to seven stations were sampled three times during the summer season. None of these compounds were detected instream.

A screening study for volatile organics was conducted during the 1986 surveys. Since these compounds volatilize quickly after their release they were generally not detected in the river.

b. Sediment

Very little sediment has been found by DEP/TSB in the freshwater portions of the Merrimack River, accounting for the small numbers of analyses for both metals and synthetic organics (Hanley, 1987).

c. Fish and Shellfish

The levels of toxins in the flesh of fish and shellfish are important not only for human consumptive issues, but as an indication of ambient water quality.

Fish and shellfish have been sampled in the Merrimack River both by the U.S. Fish and Wildlife Service (USFWS) (Carr, 1984), and the DEP/TSB (Maietta, 1987).

The USFWS found levels of copper, lead, mercury, and cadmium in Merrimack River fish met or exceeded the national 85th percentile level of all fish collected during 1980-81. The DEP/TSB, using different methodology, found approximately comparable metals levels. However, DEP fisheries experts noted that these levels were similar to samples taken statewide. Concentrations of PCB's were generally below the Food and Drug Administration action level of 2 ppb.

D. Water Quality Testing

Water quality testing of the freshwater portion of the Merrimack River is done by several different agencies within the Commonwealth on a regular basis - the Department of Environmental Protection, Technical Services Branch (TSB), the five drinking water suppliers, and the Lowell and Greater Lawrence WWTPs. Most of the river testing which does occur, is fairly site-specific, e.g., much river data are collected in the vicinity of each water supply. The TSB conducts the only basin-wide water quality investigations.

As a commitment to this Merrimack River initiative, DEP has attempted to identify and organize the available data on "raw" or untreated river water (the testing of the "treated" Merrimack water is discussed briefly in Chapter IV.) In this way data gaps which exist, either in the amount or type of information being collected, can then be discussed and corrected. The following paragraphs will briefly summarize the extent, type, and location of data available to characterize Merrimack River water quality.

1. DEP Technical Services Branch

The DEP, Technical Services Branch conducts major water quality surveys on the Merrimack River every two to five years. Water quality reports and data analyses are available from 1965 to the present for the mainstem and tributaries. Parameters sampled for range from conventional pollution measures such as BOD, nutrients, and coliform bacteria, to heavy metals and a limited number of organic and toxicity samples. The surveys typically involve sampling of the river at 10 to 30 locations several times during a season. In addition, selected wastewater treatment plant effluents are concurrently sampled. The TSB has also done biological sampling of the river including invertebrates

and fish. Major tributaries are sampled in a similar way, again at intervals of several years.

As part of this Merrimack River Initiative, the TSB has undertaken a series of river surveys during 1989. In an attempt to capture worst-case quality conditions, sampling took place during the summer lowflow conditions. Dry weather samples were taken from 13 river locations from Tyngsborough to Haverhill three times during the summer. Approximately 30 parameters were studied at each station including dissolved oxygen, coliform bacteria, heavy metals, nutrients, and synthetic organics. Wet weather samples were taken from the same 13 locations for fecal and total coliform bacteria four times during the summer.

As a further commitment to the Merrimack River Initiative, the TSB has undertaken a data management program. Merrimack River survey data since 1986 have been entered into a computerized database in dBase. Data is arranged by TSB sampling station and date and includes numerous parameters including bacteria, nutrients, and heavy metals.

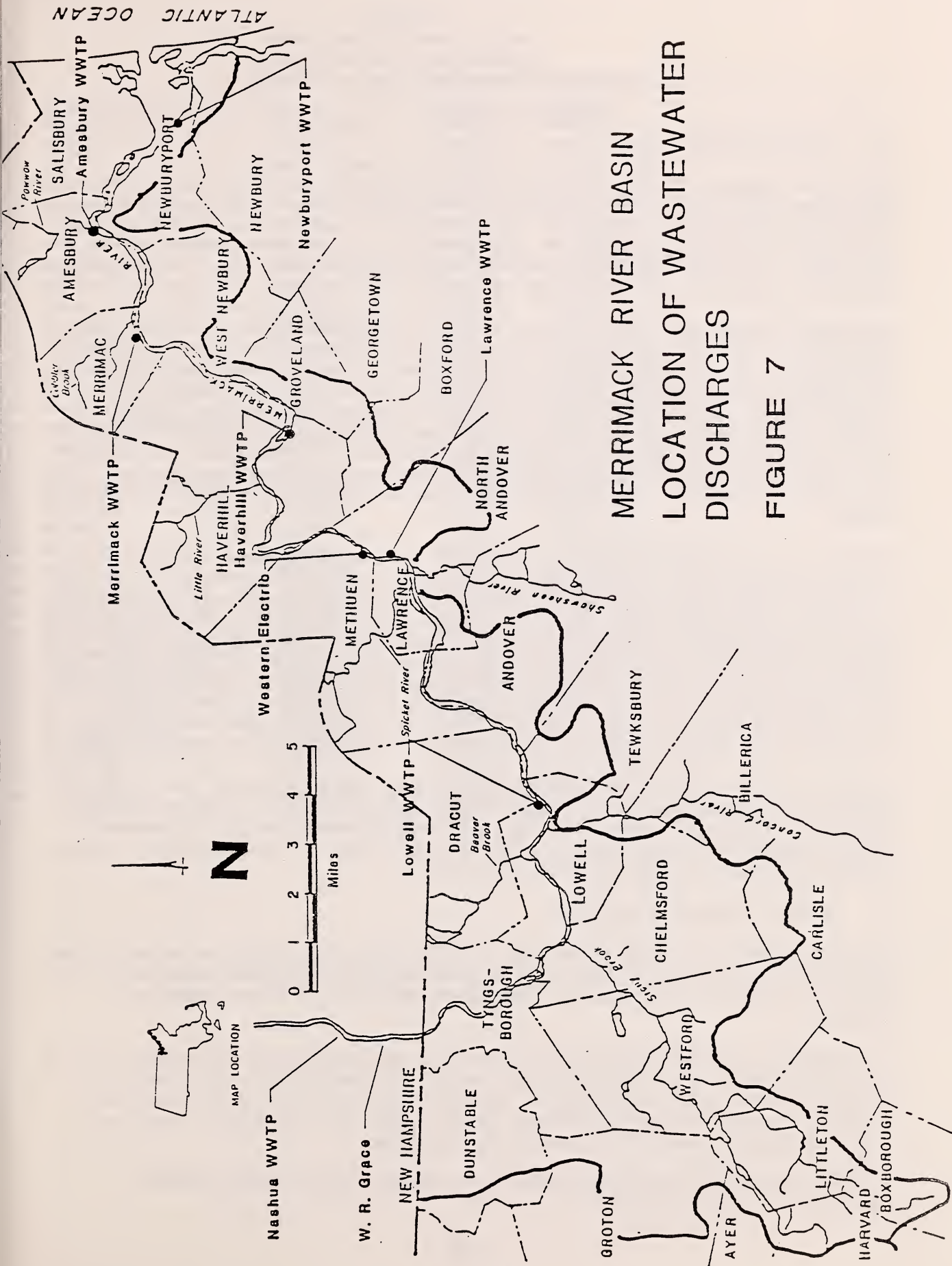
2. Merrimack River Monitoring by Drinking Water Treatment Plants

The five water treatment plants (WTPs) in Massachusetts on the Merrimack River in Lowell, Tewksbury, Methuen, Andover, and Lawrence test the "raw" or untreated Merrimack River water for a number of parameters. All of the WTPs but Lawrence have modern laboratory facilities. The WTPs' main mission is to monitor "treated" water, on which most laboratory time is spent.

Each plant tests "raw" water only at its intake. Information exchange between the plants is limited and informal. Raw water parameters monitored are primarily conventional chemical parameters including total coliform bacteria, color, turbidity, and sodium, with infrequent testing for heavy metals, synthetic organics, or fecal coliform bacteria.

3. Merrimack River Monitoring by Wastewater Treatment Plants

Both the Lowell and Greater Lawrence Wastewater Treatment Plants (WWTPs) are required to monitor the Merrimack River as part of their NPDES Permit requirements. The Lowell WWTP monitors five locations on the Merrimack mainstem and five tributary sites on a monthly basis. They have gathered a good database on conventional chemical parameters including dissolved oxygen, temperature, total and fecal coliform bacteria and are beginning to compile a metals database. The Greater Lawrence WWTP samples two sites upstream, and one site downstream of the WWTP on a weekly basis for conventional chemical parameters.



VI. WASTEWATER TREATMENT PLANT DISCHARGES

A. Introduction

Wastewater Treatment Plants (WWTPs) both in Massachusetts and New Hampshire, are among the primary pollution sources on the Merrimack River. The wastewater discharges of primary interest for this study are those upstream of present and potential drinking water supplies. The treatment plants may be industrial or municipal. It should be noted, however, that municipal WWTPs can have significant industrial inputs (see Pretreatment section in this chapter).

Wastewater discharges to all surface waters in the Commonwealth, including the Merrimack River and its tributaries are governed by permits which are co-issued by the United States Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (DEP) in accordance with guidelines established as part of the National Pollutant Discharge Elimination System (NPDES). This system establishes levels of effluent quality to be maintained at the Wastewater Treatment Plants (WWTPs) and designates implementation schedules for meeting effluent limits for discharges that contribute to water quality standards violations. NPDES permits are usually reviewed and reissued every five years.

Wasteload allocations (basically for BOD) on the Merrimack River and its tributaries were derived comparably to other rivers in the Commonwealth. On the mainstem, since the river's lowest flow relative to WWTP discharges is large, the mainstem is considered effluent limiting, i.e., technology based discharge limits apply, necessitating secondary treatment of effluents. Some tributary WWTPs have advanced BOD and ammonia treatment limits based on low relative river flows. In addition to other chemical testing required by NPDES permits, most industries and municipalities are (or soon will be), required to test their discharges for toxicity to aquatic life (see Section VI-D). The toxicity tests are meant to identify problems not apparent when looking at effluent chemical-specific data.

However, in the case of the Merrimack River, the most vital water use is not aquatic life protection, but drinking water supply protection. EPA has not yet developed discharge criteria for the protection of human health. In general, aquatic organisms may be more sensitive to toxics than humans. However, specific human health issues require further attention.

B. NPDES Inventory and Ranking

Table 3 presents an inventory of the 34 major NPDES wastewater discharges to the Merrimack River and its tributaries. A listing of all 154 NPDES discharges in the basin is included in Appendix D. The major* mainstem WWTPs are mapped on Figure 7.

In assessing risk from these WWTP discharges, the principle factors which will be used, are proximity to drinking water supply, treatment plant volumetric flow, and industrial input to the discharge. These factors combine to form a potential impact. In this way WWTP discharges can be ranked in a rudimentary way, as to their potential impacts to drinking water supplies.

* Major discharges have flows greater than 50,000 gal/day and/or contain potentially toxic pollutants.

TABLE 3
MERRIMACK RIVER SYSTEM
MAJOR NPDES DISCHARGES

<u>FACILITY</u>	<u>CITY</u>	<u>NPDESNO</u>	<u>RECWATER</u>
1 ADVANCE COATINGS CO	WESTMINSTER	MA0024686	NASHUA RIVER
2 AMESBURY	AMESBURY	MA0101745	MERRIMACK & BACK RIVERS
3 AT&T	NORTH ANDOVER	MA0001261	MERRIMACK RIVER
4 AYER WTF	AYER	MA0100013	NASHUA RIVER
5 BILLERICA-LETCHWORTH AVE WTP	BILLERICA	MA0101711	CONCORD RIVER
6 CONCORD	CONCORD	MA0100668	CONCORD RIVER
7 DELTA SUPRENANT WIRE AND CABLE	CLINTON	MA0001783	RIGBY BROOK
8 EXXON COMPANY, USA	DRACUT	MA0022225	MERRIMACK RIVER
9 FITCHBURG, EAST WWTP	FITCHBURG	MA0100986	NASHUA RIVER
10 GENERAL LATEX & CHEMICAL CORP	BILLERICA	MA0004529	OPEN DITCH
11 GOULD INC.	NEWBURYPORT	MA0000281	MERRIMACK RIVER
12 GREATER LAWRENCE SD	NORTH ANDOVER	MA0100447	MERRIMACK RIVER
13 HAVERHILL WPAF	HAVERHILL	MA0101621	MERRIMACK RIVER
14 HOLLINGSWORTH & VOSE CO.	GROTON	MA0004561	SQUANNACOOK RIVER
15 HUDSON WWTF	HUDSON	MA0101788	ASSABET RIVER
16 JAMES RIVER-PEPPERELL, INC.	EAST PEPPERELL	MA0005185	NASHUA RIVER
17 LEOMINSTER DPW	LEOMINSTER	MA0100617	NASHUA RIVER NORTH
18 LOWELL MSS	LOWELL	MA0100633	MERRIMACK RIVER
19 MARLBOROUGH STP (EAST)	MARLBOROUGH	MA0100498	HOP BROOK
20 MARLBOROUGH WESTERLY WTF	MARLBOROUGH	MA0100480	ASSABET RIVER
21 MAYNARD STP	MAYNARD	MA0101001	ASSABET RIVER
22 MWRA-CLINTON FACILITY	CLINTON	MA0100404	NASHUA RIVER, SOUTH BR
23 NEWBURYPORT WPCF	NEWBURYPORT	MA0101427	MERRIMACK RIVER
24 POLYSAR INCORPORATED	LEOMINSTER	MA0000442	WASS BROOK
25 RAYTHEON CO-WAYLAND LAB	WAYLAND	MA0001511	SUDBURY RIVER
26 RAYTHEON CORPORATION	BILLERICA	MA0001414	CONCORD RIVER
27 SALISBURY SEWER COMMISSION	SALISBURY	MA0102873	MERRIMACK RIVER
28 SILICON TRANSISTOR CORP	CHELMSFORD	MA0025241	BEAVER BROOK
29 VERYFINE PRODUCTS, INC.	LITTLETON	MA0004936	MILL BROOK
30 WEST FITCHBURG WTF	FITCHBURG	MA0101281	NASHUA RIVER
31 WESTBOROUGH WTP	WESTBOROUGH	MA0100412	ASSABET RIVER
32 WESTFORD ANODIZING	GRANITEVILLE	MA0024414	STONE BROOK
33 NASHUA WWTP	NASHUA, N.H.	NH0100170	MERRIMACK RIVER
34 W.R. GRACE	NASHUA, N.H.	NH0000591	MERRIMACK RIVER

Major NPDES wastewater permittees have been divided into municipal and industrial classes in Tables 4 and 5 respectively. In addition, these tables include information on wastewater volumetric flows and distance from nearest present or potential water supply. The municipal discharges have been ranked according to both wastewater flow and distance using the formula (flow x 1/distance to nearest water supply) to yield a rough relative estimate of the discharge's potential impact to a water supply. Industrial discharges were not ranked in this way since their processes and treatment processes vary.

For municipal WWTPs, based on the size, industrial input, and nearness to water supply criterion, the Lowell WWTP is of primary interest to this study; it is large and only two miles upstream of the Tewksbury water supply intake.

Large WWTPs exist in New Hampshire on the Merrimack mainstem, notably the Nashua WWTP, and the W.R. Grace WWTP, and are about 10 and 6.5 miles respectively from the Lowell water supply intake. These are followed in importance by those WWTPs on the Merrimack River tributaries - the Nashua and Concord Rivers and Stony Brook*. The Greater Lawrence WWTP, a very large discharge with industrial input, and AT&T, North Andover, are upstream of a potential water supply in Haverhill.

Because of their significance to river water quality, the following sections will discuss information about several of the river's major WWTPs.

* It should be noted also, that the Town of Billerica withdraws its drinking water from the Concord River.

TABLE 4
MERRIMACK RIVER SYSTEM
MAJOR MUNICIPAL NPDES DISCHARGES (WITH RANKING)

FACILITY	CITY	NPDESNO	RECWATER	PERFLOW	WDISTANCE	COMPACTOR
LOWELL MSS	LOWELL	MA0100633	MERRIMACK RIVER	26.00	2.00	13.00
GREATER LAWRENCE SD	NORTH ANDOVER	MA0100447	MERRIMACK RIVER	43.00	6.60	6.52
NASHUA WTP	NASHUA	NH0100170	MERRIMACK RIVER	16.00	10.00	1.60
WEST FITCHBURG WTP	FITCHBURG	MA0101281	NASHUA RIVER	15.40	56.00	0.28
FITCHBURG, EAST WTP	FITCHBURG	MA0100986	NASHUA RIVER	12.48	48.10	0.26
BILLERICA-LEITCHWORTH AVE WTP	BILLERICA	MA0101711	CONCORD RIVER	1.60	6.50	0.25
LEOMINSTER DPW	LEOMINSTER	MA0100617	NASHUA RIVER NORTH	9.36	46.40	0.20
WESTBOROUGH WTP	WESTBOROUGH	MA0100412	ASSABET RIVER	7.68	48.50	0.16
MARLBOROUGH STP (EAST)	MARLBOROUGH	MA0100498	HOP BROOK	5.54	35.50	0.16
HUDSON WTP	HUDSON	MA0101788	ASSABET RIVER	2.63	34.00	0.08
MURA-CLINTON FACILITY	CLINTON	MA0100404	NASHUA RIVER, SOUTH 8R	3.00	38.00	0.08
AYER WTP	AYER	MA0100013	NASHUA RIVER	1.82	24.90	0.07
CONCORD	CONCORD	MA0100668	CONCORD RIVER	1.20	18.00	0.07
MAYNARD STP	MAYNARD	MA0101001	ASSABET RIVER	1.43	24.80	0.06
MARLBOROUGH WESTERLY WTP	MARLBOROUGH	MA0100480	ASSABET RIVER	1.90	42.10	0.05
AMESBURY	AMESBURY	MA0101745	MERRIMACK & BACK RIVERS	1.90		0.00
NEWBURYPORT WPCF	NEWBURYPORT	MA0101427	MERRIMACK RIVER	3.40		0.00
SALISBURY SEWER COMMISSION	SALISBURY	MA0102873	MERRIMACK RIVER			0.00
HAVERHILL WPAF	HAVERHILL	MA0101621	MERRIMACK RIVER	18.10		0.00

*NPDES Permit Flow

**Distance to nearest downstream Merrimack River water supply

***Comparison Factor for rating purposes (see text)

TABLE 5
MERRIMACK RIVER SYSTEM
MAJOR INDUSTRIAL NPDES DISCHARGES

FACILITY	CITY	NPDESNO	RECWATER	PERFLOW*	MSDISTANCE**
ADVANCE COATINGS CO	WESTMINSTER /T/	MA0024686	NASHUA RIVER	0.10	
AT&T	NORTH ANDOVER	MA0001261	MERRIMACK RIVER	1.84	5.50
DELTA SUPREMANANT WIRE AND CABLE CLINTON		MA0001783	RIGBY BROOK	2.00	0.00
EXXON COMPANY, USA	DRACUT	MA0022225	MERRIMACK RIVER		
GENERAL LATEX & CHEMICAL CORP	BILLERICA	MA0004529	OPEN DITCH		
GOULD INC.	NEWBURYPORT	MA0000281	MERRIMACK RIVER	0.09	
HOLLINGSWORTH & VOSE CO.	GROTON	MA0004561	SQUANNAHOOK RIVER	5.20	26.30
JAMES RIVER-PEPPERELL, INC.	EAST PEPPERELL	MA0005185	NASHUA RIVER	1.89	13.50
POLYSAR INCORPORATED	LEOMINSTER	MA0000442	WASS BROOK	0.05	
RAYTHEON CO-WAYLAND LAB	WAYLAND	MA0001511	SUDBURY RIVER	0.05	26.00
RAYTHEON CORPORATION	BILLERICA	MA0001414	CONCORD RIVER	0.09	5.30
SILICON TRANSISTOR CORP	CHELMSFORD	MA0025241	BEAVER BROOK	0.08	6.10
VERYFINE PRODUCTS, INC.	LITTLETON	MA0004936	HILL BROOK	0.88	17.00
WESTFORD ANODIZING	GRANITEVILLE	MA0024414	STONEY BROOK	0.03	9.50
W.R. GRACE	NASHUA	NH0000591	MERRIMACK RIVER	0.50	7.20

*NPDES Permit Flow

**Distance to nearest downstream Merrimack River water supply

C. Significant Discharges

1. Lowell Wastewater Treatment Plant

The Lowell Wastewater Treatment Plant (WWTP), using a conventional secondary activated sludge process with disinfection via chlorination of the final effluent, is the most important facility on the Massachusetts portion of the Merrimack River with respect to potential water supply impact. It currently discharges about 26 million gallons per day (MGD) of treated effluent upstream of the drinking water supplies of four major communities - Lawrence, Methuen, Andover, and Tewksbury.

The facility has a design capacity of 32 MGD, a peak secondary capacity of 64 MGD, and a primary capacity of 112 MGD. The high primary capacity is intended for wet weather flow and flow beyond this is discharged without treatment via combined sewer overflows to the Merrimack River.

This WWTP has had major NPDES permit and operation and maintenance violations in the recent past; thus, the city of Lowell has been under a joint DEP/EPA Consent Order since November 1988. Within the past year the city has made substantial progress toward rehabilitating almost all of the major operating equipment in the facility. The city has established a new management structure for the operation of the WWTP, and has hired many new management, middle management, and operations staff. The city is currently updating its pretreatment program and has worked with DEP in enforcement actions against industries. In general, the city has maintained a good record of compliance during the past 1.5 years since the initial filing of the Consent Order.

Despite this good recent progress, the city of Lowell and its WWTP have problems remaining. Major among them is the condition of the Lowell sewer system. Inflow and infiltration of groundwater and stormwater to the system are major problems. During rainstorms the overloaded combined sewer system overflows up to several million gallons per day of untreated sewage at nine locations to the Merrimack River.

In addition, the Lowell WWTP frequently bypasses secondary treatment during storms. The consulting firm of Camp Dresser and McKee (CDM) has been retained by the city to study the combined sewer overflow (CSO) problem, in which a preliminary WWTP operations review will occur.

Additional work will be needed beyond the current Consent Order. Specifically, it is necessary to develop a comprehensive sewer system routine maintenance program, and to study and implement the proposals from the upcoming CDM report concerning inflow and infiltration, WWTP operations, and CSO remediation.

Finally, the Lowell WWTP is fast approaching 80 percent design capacity, which according to its NPDES permit, must trigger facilities planning to prevent water quality violations. Historically, the facilities planning process takes so long that WWTP overloading frequently occurs in the meantime. Strict controls should be in place to prevent this including limits on new tie-ins to the facility and/or a major inflow and infiltration reduction program.

2. Greater Lawrence Sanitary District (GLSD) Wastewater Treatment Plant

The Greater Lawrence Sanitary District Wastewater Treatment Plant is a conventional secondary treatment facility with disinfection of its final effluent via chlorination. It is the largest WWTP in the northeastern region of Massachusetts, releasing an average of 34 million gallons per day of treated effluent to the Merrimack River. Although the plant is not currently upstream of a water supply, it may be in the future if Haverhill is allowed to withdraw drinking water from the Merrimack River.

This WWTP also has had major NPDES permit and operation and maintenance violations in recent years. These violations have resulted in several enforcement actions both at the Federal and State levels. The federal actions include three orders, one issued recently by EPA with a proposed penalty of \$50,000. The state actions one signed Consent Order and two outstanding penalty assessments for \$25,000 and \$27,000 from the DEP Division of Air Quality Control and Water Pollution Control, respectively, in addition to a comprehensive plant evaluation and report by the DEP Technical Assistance Branch. The Division of Water Pollution Control has made an effort to negotiate with the GLSD as demonstrated by the recent draft Consent Order with a proposed penalty of \$352,000 delivered to GLSD on March 20, 1989. Since the State has been unable to resolve the matter on a timely basis, the matter was referred to the office of the Attorney General on May 10, 1989.

The recent report by the DEP Technical Assistance Branch (Hartley, 1988) had the following conclusion concerning the GLSD:

"The GLSD has the capability to comply with all NPDES permit parameters. To do so, however, GLSD must be willing to make permit compliance their number one priority. This would require an effective managerial strategy incorporating process control, limitations on the amount of septage received, a pretreatment program which stresses industrial treatment and compliance monitoring, and a strengthening of communication and teamwork."

Some headway has been made toward addressing these issues in the past year.

The Lawrence sewer system is also a combined storm/sanitary system, with four NPDES permitted CSO discharges to either the Merrimack or Spicket Rivers. For example, during April of 1989, an estimated 78 million gallons of untreated sewage was released to the Merrimack River. According to officials at the DEP NERO, the frequency of discharges from CSOs should begin to decrease now that the WWTP Process Control Engineer has been attempting to accept as much flow as possible prior to bypassing.

Further work needs to be done in complying with conditions in the recent Consent Order to study facility operations so as to further decrease CSO discharges. In addition, a comprehensive sewer system maintenance program needs to be initiated; CSO studies in other areas of the Commonwealth indicate this to be a cost effective means to decrease CSO discharges.

3. Nashua, New Hampshire, Wastewater Treatment Plant

The Nashua, NH Wastewater Treatment Plant has only recently (November 1989) been upgraded from a primary to a secondary wastewater treatment process. This upgrade will have a major positive impact on Merrimack River water quality. The facility is located only 3.6 miles from the Massachusetts border; so, it has had and will continue to have, a major impact on the Merrimack River in Massachusetts upstream of Lowell.

The Nashua WWTP currently has a design capacity of 16 MGD. During storms it can provide primary treatment and disinfection to 50 MGD. The Nashua sewer system also has six combined sewer overflows, which have, to date, received little study. The Nashua WWTP also has 160 industrial tie-ins of which 60 are considered significant, and has a pretreatment program dating back to 1985.

It is also of interest to note that although this WWTP has a current design capacity of 16 MGD, it has been designed to facilitate an upgrading to 29 MGD. Construction for this upgrade is projected to take place in about five years.

4. AT&T Technologies, Inc., North Andover

The AT&T Technologies, Inc.: Network systems facility manufactures equipment and parts for telephone and telegraph use. Most of the plant's wastewaters are the rinse waters from the etching of printed circuit boards; copper, nickel, and gold electroplating; and thin film making and quartz crystal etching. Additional wastewater is contributed by the spent metal finishing baths, reverse osmosis/water purification reject, and sanitary wastewater.

Most of the wastewater is treated by neutralization, followed by application of ferric chloride and non-ionic polymer flocculation, and the precipitation of metal hydroxides. Hexavalent chromium is reduced to the trivalent form with sodium bisulfate. Cyanide is batch treated in an alkaline chlorination process. The sanitary wastewater chlorination is year round. The total NPDES average monthly permitted flow from a combination of discharges is 1.6 MGD.

5. W. R. Grace Company, Nashua, N.H.

The W.R. Grace Company, in Nashua, N.H. is a manufacturer of a variety of organic and inorganic chemicals. The company has an NPDES discharge of 0.35 MGD. Components of the discharge include BOD, solids, ammonia, cyanide, and the metals copper, zinc, manganese and iron.

The company has, in the past year, completed and put on line, a biological activated sludge wastewater treatment system. The system is working fairly well, according to NH Water Supply and Pollution Control (NHWSPC) officials. For example, BOD loading is reportedly greater than 90 percent reduced from the very high levels prior to the new system's installation. Due to the nature of chemical manufacture, though, this is a discharge to which close attention must be paid.

The W.R. Grace Company is presently the subject of an EPA Draft Corrective Action Permit concerning Resource Conservation and Recovery Act (RCRA) problems with chemical disposal on the company's site. W.R. Grace will be required to evaluate about 26 sites on its property via test pits and wells. The process will probably take several years. In the meantime, both the company, and the NHWSPC have been monitoring for cyanide in the Merrimack River on a weekly basis and have, so far, not found any.

D. Pretreatment

"Pretreatment" is a term used to describe the treatment of industrial wastewater prior to its discharge into municipal wastewater treatment plants. Pretreatment of industrial wastewater is necessary to eliminate interference with the operation of the municipal system to prevent a pass through of untreated pollutants to the receiving water, to ensure the quality of sludge, and to protect WWTP workers from chemical hazards.

Pretreatment is a key element in Merrimack River protection. Ensuring that pretreatment standards are adequate, enforced and applied to all communities with significant industrial use of WWTPs is a highly significant way to protect the Merrimack River from pollution of industrial origin. Currently, eleven communities in the Merrimack Basin have pretreatment programs, as shown in Table 6. Seventy-four (74) significant industries are tied-in to municipal WWTPs in Massachusetts on the Merrimack mainstem, and 38 on tributaries upstream of present or potential water supplies. Substantial numbers of industries are also tied-in to municipal systems in New Hampshire.

Heavy metals concentrations in the Merrimack River are high and several metals such as lead, mercury, and copper are at places higher than the EPA instream water quality criteria. In addition, recent evidence suggests that relatively high metals concentrations may travel down the Merrimack River in discrete "slugs" and that these "slugs" originated at discrete discharge points. Thus, instream metals concentrations indicate that further reductions in metals discharge to the Merrimack River in New Hampshire and Massachusetts are necessary.

1. Regulatory Approach of Pretreatment Programs

Pretreatment programs are administered at the local WWTP level, under EPA general Pretreatment Regulations (40 CFR 122, 123) and Massachusetts Regulations (314 CMR 12:00). The General Pretreatment requirements are included in NPDES permits.

Successful operation of a pretreatment program is very much dependent on a committed pretreatment coordinator at the local WWTP. Municipal WWTPs with pretreatment programs must identify "significant" industrial sewer users. "Significant" may be users generating more than 10,000 gallons/day, or may be users in categorical EPA mandated pretreatment industries.

Actual limits imposed by the municipalities on industries using municipal WWTPs are either EPA categorical limits, or local limits (which may be more stringent), developed to protect water quality or POTW sludge. Current local limits should be reexamined in accordance with the new EPA guidance manuals to ensure that the most proper technical basis for all limits is used.

A recent General Accounting Office report was sharply critical of the national pretreatment program's effectiveness and recommended a number of improvements including increased enforcement, better monitoring, and reviews of local limits.¹

1 General Accounting Office, "Improved Monitoring and Enforcement Needed for Toxic Pollutants Entering Sewers." Resources, Community, and Economic Development Division, GAO/RCED-89-101, April 1989.

TABLE 6
MERRIMACK BASIN PRETREATMENT COMMUNITIES

CITY/TOWN	PROGRAM ¹ STATUS	SUB-BASIN	Upstream of Present/Potential WATER SUPPLY?	Categorical I.U. ²	Significant I.U. ²
Amesbury	A	Merrimack	No	8	10
Ayer	N	Nashua	Yes	1	7
Billerica	A	Concord	Yes	7	16
Fitchburg	A	Nashua	Yes	8	10
Greater Lawrence S.D.	A	Merrimack	Yes	20	33
Haverhill	A	Merrimack	No	15	25
Leominster	A	Nashua	Yes	6	5
Lowell	N	Merrimack	Yes	26	41
Marlborough	N	Concord	Yes	—	—
Newburyport	A	Merrimack	No	11	11
Westborough	N	Concord	Yes	—	—

¹ A: approved

N: not approved

² Industrial User

2. Pretreatment Monitoring

POTWs are required to conduct annual inspections and discharge monitoring of all pretreatment industries. EPA or DEP does yearly inspections of POTW records. In addition, every five years EPA will do a more detailed pretreatment audit and will actually inspect some industries in order to monitor the effectiveness of the POTW inspection system.

Additionally, the Massachusetts DEP issues sewer connection permits, a program which has been used effectively as another method of monitoring industries tied into municipal sewers. Recently the DEP Division of Water Pollution Control in cooperation with the Lowell WWTP and EPA has uncovered approximately ten (10) industrial users of the Lowell municipal system without DEP sewer connection permits. Enforcement action was taken against these companies by either DEP or EPA.

Currently, no actual pretreatment discharge monitoring is done by either EPA or the state. Spot checks, and periodic checks of major pretreatment industrial discharges, particularly in high priority areas such as Lowell (and Nashua, NH) would be an important component in determining the effectiveness of pretreatment programs.

3. Conclusion

Some metals concentrations in the Merrimack River are above EPA instream water quality criteria. These metals are likely to be of industrial origin. Many industries both in Massachusetts and New Hampshire are tied-in to municipal wastewater treatment plants (WWTPs). Pretreatment of industrial wastes therefore, is important to ensure that this waste does not enter the Merrimack River, since municipal WWTPs are not designed to treat materials such as metals. It is, thus, economical, effective, and prudent to ensure that industrial wastes are treated at their sources rather than at municipal WWTPs. To this end DEP recommends increased monitoring, better enforcement, and reviews of local limits in both Massachusetts and New Hampshire.

E. NPDES Permittee Toxicity Testing

The Declaration of Goals and Policy, Section (a)(3) of the Federal Water Pollution Control Act Amendments of 1972, 1977, and 1987, states that "it is the national goal that the discharge of toxic pollutants in toxic amounts be prohibited." It is with this intention that effluent toxicity data is used in conjunction with chemical specific data in NPDES permitting to ascertain the potential impact of complex effluents on river biota. Thus, toxicity testing in conjunction with dilution data can be used as a surrogate of the overall impact of a discharge to a receiving stream.

As part of the Merrimack Initiative Project, a chronic aquatic life toxicity screening has been conducted by EPA contract laboratories on most of the major and significant minor permitted discharges within the Merrimack River Watershed. In the state of Massachusetts, three river basins comprise the major portion of the Merrimack River Watershed - the Merrimack River Basin, the Nashua River Basin, and the SUASCO River Basin. Within these three river basins, there are 37 NPDES major

and significant minor permitted discharges. Information for the Merrimack River mainstem is presented in Appendix E.

For the purpose of this report, the Merrimack Initiative chronic toxicity test information has been supplemented with other sources of toxicity information including toxicity testing conducted as part of the MDWPC water quality surveys and toxicity data collected as part of the NPDES permit requirements. The various toxicity tests conducted on these discharges include seven-day chronic tests with Ceriodaphnia dubia and Pimephales promelas, 48-hour acute tests with Daphnia pulex and Pimephales promelas, and Microtox[™] acute toxicity analyses with Photobacterium phoshoreum.

The MDWPC Toxics Policy bases toxicity limits and monitoring requirements upon dilution available to the permitted discharge flow at critical streamflow conditions (7Q10). The dilution categories and corresponding toxicity limits are outlined below.

<u>RWC</u> ¹	<u>Toxicity Limit</u>
>5%	RWC<NOEC
1-5%	LC ₅₀ >100%
<1%	LC ₅₀ >50%

$$^1 = \text{Receiving Water Waste Concentration: } \frac{\text{Permitted Effluent Flow} \times 100}{\text{Total Flow (}=\text{Permitted Effluent Flow} + 7Q10 \text{ Flow)}}$$

It should also be noted here that the proposed toxicity limits for the municipal discharges are for either prechlorinated or dechlorinated effluent. The state is formulating a policy on the use of chlorine for the purpose of disinfection which is considered a separate issue in the toxics policy. Therefore, the toxicity tests conducted on chlorinated municipal treatment plant effluents could not be assessed by comparison with the toxics policy.

The only discharge to the mainstem Merrimack River which has exceeded its proposed toxicity limits based on Microtox toxicity analyses was the Lowell POTW. When this discharge was retested in September 1989 it did not exhibit any chronic toxicity to ceriodaphnids. The five other mainstem discharges tested did not exceed their proposed toxicity limits. The Raytheon Company discharges on the Concord and Sudbury Rivers were extremely toxic and merit further investigation.

A few cautionary items should be noted in interpreting this data. First, the term "toxicity" as used in this section means only toxicity to aquatic life. Second, the sample size for most discharges is small and so does not track effluent variability, if it exists. Third, the predicted toxicity effects on a Merrimack tributary cannot be extrapolated to mean that instream toxicity will eventually be felt in the Merrimack mainstem. Overall, the science of effluent toxicity testing, standards, regulations, and interpretations is in an evolutionary state and is best interpreted as a screening tool for purposes of this report.

Finally, as noted earlier in this chapter, large discharges upstream of present or future Merrimack River water supplies, with very toxic discharges or with industrial components, such as the municipal discharges of Nashua, Lowell, and Lawrence, merit further attention and toxicity testing in relation to both human and aquatic life.

VII. COMBINED SEWER OVERFLOWS

A. Introduction

Today it is standard engineering practice to design separate piping for sanitary sewage and stormwater runoff. The sewage is usually conveyed to a wastewater treatment facility while the stormwater is usually discharged to a nearby waterbody with little, if any, treatment.

However, in the past it was standard practice to design piping systems to convey both sewage and stormwater to a nearby waterbody without treatment, as illustrated in Figure 8. This was the case in several older Merrimack River communities including the major population centers in Massachusetts of Lowell, Lawrence, and Haverhill, as well as, in several communities in New Hampshire including Nashua and Manchester. As time went on, public health and receiving water quality concerns necessitated some degree of wastewater treatment. Thus, large collection "interceptor" sewers were constructed to convey combined sewage/stormwater flows to a wastewater treatment plant (WWTP). However, the interceptor sewers and WWTPs were usually designed, for economic considerations, to handle only a limited amount of combined flow during storms. The flow in excess of the system's capacity is discharged to the receiving water via "Combined Sewer Overflows (CSOs)."

During wet weather, therefore, the Merrimack River receives untreated CSO discharges of sewage/stormwater at many locations in both New Hampshire and Massachusetts. No pragmatic, basin-wide planning exists for prioritizing, funding, and correcting CSO problems, many of which, such as in New Hampshire, Lowell and Lawrence, are upstream of major existing or potential Massachusetts water supplies.

The following paragraphs briefly summarize Massachusetts CSO information. It should be noted, however, that CSOs in New Hampshire also have impacts on the Merrimack River in Massachusetts and merit further study.

B. Significant Discharges

1. Lowell Combined Sewer Overflows

Most of Lowell's wastewater collection system was designed as a combined system. Within the interceptor system, nine combined sewer overflow (CSO) structures regulate flows to the Lowell WWTP by discharging excessive storm flows directly to the Merrimack River or its tributaries, as listed in Table F-1.

The Lowell WWTP, a secondary facility (discussed in Chapter VI) receives wastewater from Lowell, Chelmsford, Dracut, and Tewksbury. It was designed to treat an average flow of 32 MGD, a peak flow of 64 MGD, and a peak primary flow of 110 MGD. In actual practice, usually a peak flow of only 50 MGD can be optimally treated to secondary and 100 MGD to primary. Thus, if the system is conveying flows higher than about 100 MGD, CSO discharges must occur. In reality, they can occur at flows below 100 MGD due to the inability to adequately control flows to the WWTP.

The wastewater collection system consists of about 190 miles of gravity pipe, ranging in size from four to 90 inches in diameter, most of which has been in service since the early 1900s. There are four main

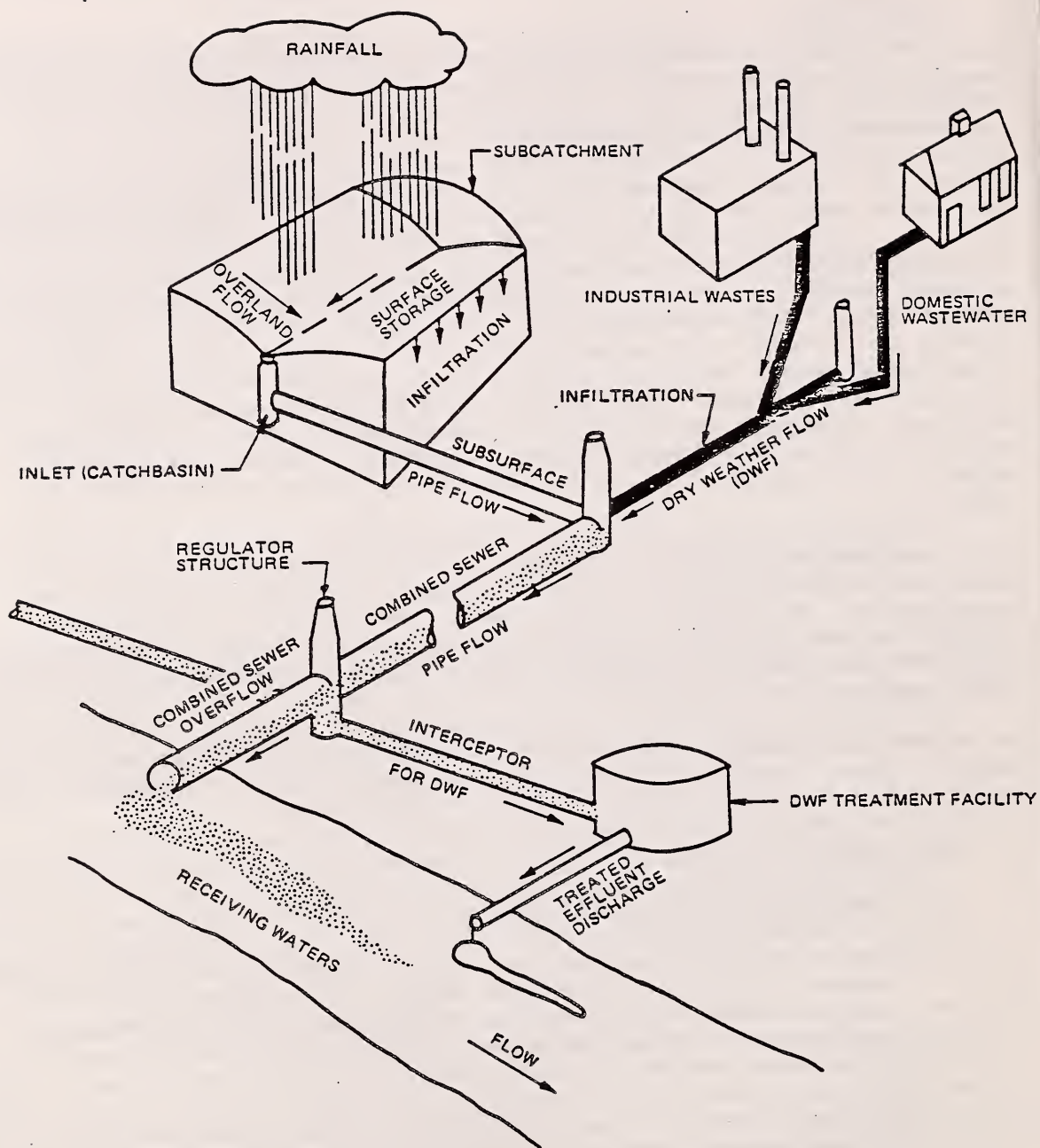


FIGURE 8

SCHEMATIC DIAGRAM OF A COMBINED SEWER SYS

interceptors in the Lowell system: the Chelmsford, North Bank, Southeast Bank I, and Southeast Bank II. Construction of the interceptor network has all been completed in the past ten (10) years.

Currently, the consulting firm Camp Dresser and McKee (CDM) is studying the Lowell wastewater system including CSOs, inflow and infiltration, and WWTP operations, all of which are closely related. Preliminary findings are that inflow and infiltration are major factors in the system, that the WWTP is handling storm loadings optimally, and that due to site restrictions, the potential for expansion of the WWTP is limited. The study will provide an updated facilities plan for CSO impact abatement. The draft report is completed and under review by DEP and EPA. Once this facility plan is reviewed and approved, implementation will have a high priority on the DEP Municipal Assistance priority list.

2. Lawrence Combined Sewer Overflows

The Greater Lawrence Sanitary District (GLSD) sewerage collection system includes interceptor lines on both banks of the Merrimack River, an interceptor sewer along the Spicket River, and the Riverside Pumping Station. The system has four CSO locations, two of them primary overflows on the north and south bank interceptors as listed in Table F-2. A number of CSOs on the Spicket River were eliminated when the Spicket River interceptor was completed recently. Flows to the WWTP are controlled by the capacity of the Riverside Pumping Station and by flow regulating devices on the north and south interceptors.

The GLSD will be required, as part of its NPDES permit, to monitor CSO discharge impact on the Merrimack River. In addition, as part of the recent Consent Order issued to the facility (see Chapter VI) GLSD will attempt to maximize the amount of flow to the WWTP prior to activating the CSOs. Recent bypasses appear to be due to the failure of the facility to utilize the full pumping capacity of the Riverside Pumping Station. The DEP Regulatory branches will evaluate information collected as part of the NPDES permit requirements and Consent Actions before issuing further orders for abatement of the CSO discharges; thus, there is no current DEP funding for CSO improvements in Lawrence.

3. Haverhill Combined Sewer Overflows

The Haverhill sewer system is primarily a combined sewage/stormwater system. There are no water supply impacts downstream of the Haverhill CSOs, but there are other sensitive downstream water uses such as fish and shellfish propagation. Interceptor sewers, constructed along the north and south banks of the Merrimack River in the mid 1970s collect this combined flow and direct it to the Haverhill WWTP. The WWTP currently treats over 10 MGD on an average annual basis, and can accept peak storm loadings of about 20 MGD.

There exist 17 combined sewer overflows in the Haverhill system, as listed in Table F-3. In a facility plan for the city of Haverhill it was estimated that 60 percent of the 75 average annual rainstorms of over 0.1 inches in Haverhill caused an overflow (CDM, 1986). There is currently no DEP funding for CSO improvements in Haverhill.

VIII. NONPOINT SOURCE CONSIDERATIONS

A. Introduction

Nonpoint source pollution refers to discharges of polluting substances to surface or groundwaters from diffuse or nonpoint sources such as road runoff as opposed to discreet or point sources such as WWTP discharges. Sources of nonpoint pollutant loadings include urban stormwater runoff, subsurface disposal systems, improper hazardous substance management, landfill leachate, in-place sediments, winter road salt runoff from roads and storage areas, soil erosion and sedimentation, and leaky underground petroleum storage tanks. Solid waste and hazardous waste management concerns will be discussed separately in Chapters IX and X.

It is difficult to quantify the effect of nonpoint source pollutant loading to the Merrimack River and environs, but it seems fairly low compared to point source influences. This is primarily because the WWTP point sources contribute proportionately large loadings to the Merrimack River of most conventional pollutants such as BOD and nutrients. This is not to say that local and possibly significant problems might occur at certain times and places, e.g., during events such as rainstorms, and at locations such as sites near landfills. In addition, evaluation is difficult since there is a very large array of possible nonpoint contaminant sources, and these sources often vary with time.

B. Urban Runoff

Urban runoff conveys dirt, dust, animal waste, oil and grease, and heavy metals such as lead from impervious surfaces where they accumulate during dry weather. Storms can wash these substances into the Merrimack River and tributaries. Effective control measures include street sweeping, catch basin cleaning, and generally improved road maintenance. Although NPDES permits have generally been applied to point source discharges, the 1987 amendments to the Federal Clean Water Act indicate that significant municipal or industrial stormwater discharges will need permits in the near future.

Much of the stormwater runoff in urban centers such as Lawrence, Lowell, and Haverhill is discharged to the Merrimack River via Combined Sewer Overflows (CSOs), as discussed previously. However, CSOs are generally considered point, not nonpoint sources.

Finally, road salt and salt storage can cause problems in the Merrimack River Basin through contamination of the river itself, or of the groundwater. Relevant Best Management Practices for the minimization of salt contamination, including information useful for municipal officials, have been compiled by DEP¹.

1

Roy, Steve P. and Gayle Birck, Road Salts and Water Supplies Best Management Practices, DEP, Office of Planning and Program Management, August 1981.

IX. SOLID WASTE

A number of active and inactive landfills exist in the Merrimack River basin and sub-basins in Massachusetts and New Hampshire. The DEP Northeast Regional Office Division of Solid Waste has compiled, in Appendix G, a narrative account of information available for Merrimack Basin sites under their jurisdiction. Landfills exist in New Hampshire with potential impact to the Merrimack River, such as the Auburn Road landfill in Londonderry, a federal Superfund site, but New Hampshire sites will not be discussed here.

Landfills are potentially the source of solids, nutrients, heavy metals and other polluting substances including plasticizers and solvents from plastics, paints, and cleaners, to either surface waters or groundwater, as illustrated in Figure 9. In general, pollutant control at some inactive sites is best achieved by capping with an impermeable cover to prevent water seepage and leachate production. Other sites, e.g., those in wetlands where trash is directly in groundwater, may need remedial measures such as physical barriers from groundwater flows. Leachate, if collected, can be treated, frequently at a municipal WWTP. Often the leachate remains untreated. Monitoring well hydrogeologic data are available for some landfills. Most data are generated by the landfill owners via engineering consultants.

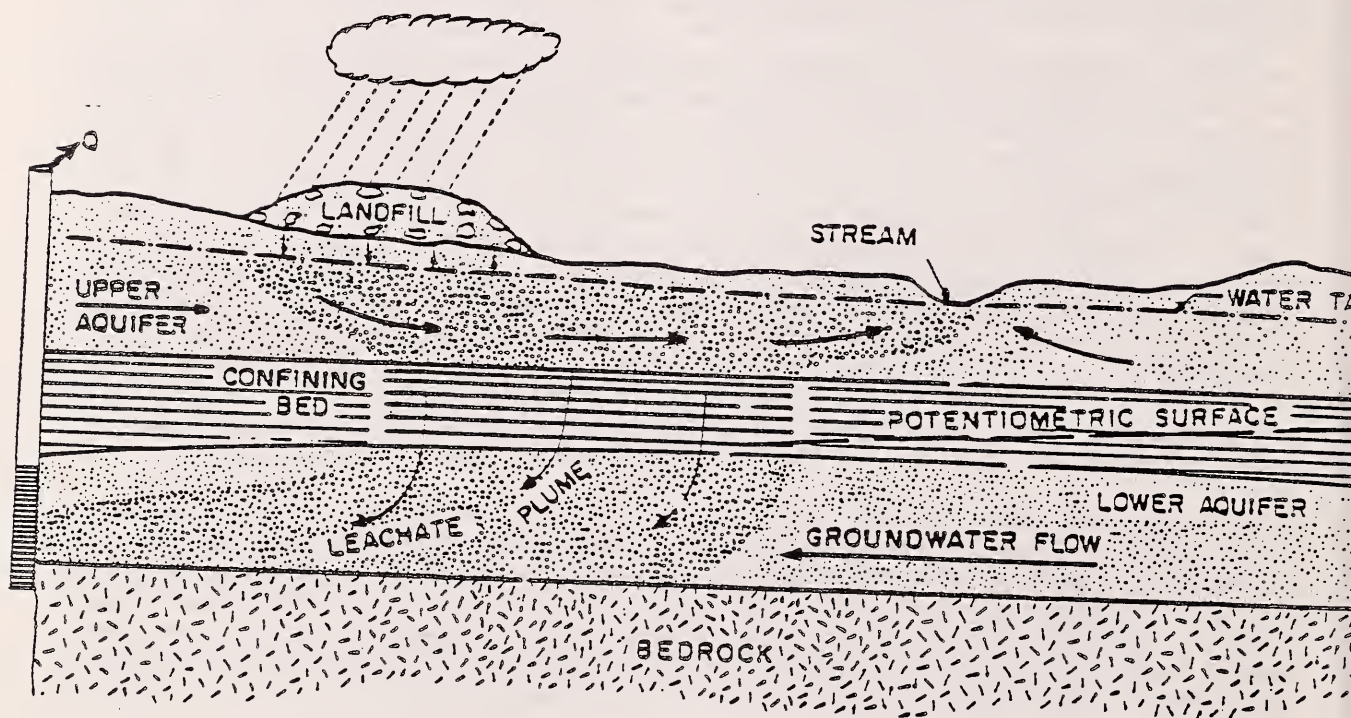
Due to dilution and slow movement of leachate in the subsurface, landfills are more likely to have significant impact on groundwater than surface water.

Solid waste site impact on surface waters is not well documented for Merrimack Basin sites, and can vary considerably from site to site. Generally, though, impacts are expected to be relatively localized. For this study, locations of particular concern are generally sites physically located close to the Merrimack River or tributaries, and upstream of water supplies. These include the Charles George landfill in Tyngsborough, and the Lowell Westford St. landfill. Further information about these locations is included in Appendix G.

Further work, including surface and groundwater sampling and Geographic Information System mapping (as described in App. B), may be of aid in determining the relative impacts of landfills to pollution problems in the basin.

FIGURE 9

LANDFILL IMPACTS ON GROUND AND SURFACE WA



Two-Aquifer System With Opposite Flow Directions. Leachate first moves into and flows with the ground water in the upper aquifer. Some of the leachate eventually moves through the confining bed into the lower aquifer where it flows back beneath the landfill and away in the other direction.

Sources: EPA report 530/SW-611, August, 1977, Office of Solid Waste, p. 66 (modified to include upgradient municipal well)

X. HAZARDOUS WASTE

A. Introduction

The Hazardous Waste Management activities of the Massachusetts DEP can be functionally divided into three areas - Emergency Response (ER), Site Assessment and Cleanup (SAC), and Resource Conservation and Recovery Act (RCRA) activities.

Of these three DEP functions, Emergency Response activities, i.e., hazardous substance spill response activities, have the most direct bearing on Merrimack River water quality. This is because the Merrimack River flows through the highly urban areas of Lowell, Lawrence, and Haverhill, alongside major highways, factors which contribute to the high potential for spills to the river or its tributaries. For example, in October of 1989 an oil tank truck accident on Route 93 nearly contaminated Fish Brook, a tributary to the Merrimack River and a source for the Andover water supply.

Other DEP hazardous substance related activities, i.e., site assessment and cleanup and RCRA have a smaller direct impact on river water quality. Existing hazardous waste sites with potential impacts to the Merrimack River, and the RCRA program are described and evaluated later in this chapter.

B. Emergency Response Activities Spills

The DEP Emergency Response (ER) Program responds to releases or threats of release of oil and hazardous materials. This program is responsible for managing cleanup of releases, assessing environmental hazards and risks from releases of oil or hazardous materials, and assisting in coordinating resources and information for rapid emergency response.

The Massachusetts Oil and Hazardous Materials List contains some 1400 specific oils and hazardous materials. These specific substances, along with any substance which is ignitable, corrosive, reactive, toxic, or infectious, must be reported if released.

Since these releases are, by definition, accidental, it is very difficult to predict impacts on the Merrimack River. It should be noted, though, that in highly urban areas, such as Lowell, Nashua, NH, Lawrence, and Haverhill, it is highly likely that an accidental release of an oil or hazardous substance may find its way into the sewer system, with a final discharge to WWTPs and ultimately, to the Merrimack River.

In order to help assess possible future hazardous substance releases, past release data have been investigated. The DEP NE Regional Office has compiled a list (Table 7) of spills greater than 1000 gallons from communities upstream of Lawrence on the Merrimack River, with potential or actual impact to the river. The records date back to 1977. In many of the cases in this table the reported quantity is an estimate and may reflect the capacity of an underground tank or above ground drums. Also, as noted in the table, only those cases so identified definitely reached a waterbody.

It is obvious that hazardous substance spills in the Merrimack Basin are always a possibility, particularly since the area is, in general highly urban. The DEP ER section reacts to and manages accidental releases, but it is also apparent that

TABLE 7
UPPER MERRIMACK RIVER
OIL/HAZARDOUS SUBSTANCE SPILLS*

1977-1989

DATE	TOWN	SPILL I.D.	LOCATION	AMOUNT	TYPE
9/87	Andover**	IRS	310 Lowell St.	2,000 gallons	#5 oil
10/89	Andover**	Parker Transportation	Rt. 495 N at Rt. 93	10,000 gallons	#2 oil
2/88	Dracut	United Christ Church	Arlington St.	1,900 gallons	#2 oil
12/78	Lawrence	US Navy Reserves	Crawford & North	1,000 gallons	#2 oil
9/81	"	General Tire	Marston Street	1,000 gallons	MEK
1/82	"**	Law Print Works	Merrimack St.	1,000 gallons	#3 oil
3/84	"	Key Polymer	Jacobs Way	<5,000 gallons	latex
12/85	"**	Institutional Linen	Brook Street	1,500 gallons	#2 oil
6/86	"	Key Polymer	Jacobs Way	600 drums	Waste oil
3/82	Lowell	Sunoco	Roger Street	8,000 gallons	Gasoline
6/85	"**	Lawrence Mfg.	Suffolk St.	1,000 gallons	#6 oil
10/85	"	Compo Ind.	200 Market St.	1,000 gallons	Veg. oil
11/84	"	Lowell Schools	Chelmsford St.	2,000 gallons	#4 oil
2/87	"	E.A. Wilson Co.	700 Broadway	2,000 gallons	#5 oil
3/87	"	Wells Metal	Crosby St.	1,000 gallons	Caustic
5/87	"	E. Metals Co.	Varum Avenue	3,000 gallons	Diesel
12/87	"**	Mystery	Merrimack River	1,000 gallons	Diesel
3/77	Methuen	Lafayette Oil	Rte. 93 & Pelham	7,000 gallons	Petroleum
12/78	"	Brian Oil	North Lowell St.	1,300 gallons	#2 oil
11/79	"	Beclay Oil	Maple Street	1,200 gallons	#2 oil
8/84	"	Lido Gas	450 Broadway	1,500 gallons	Gasoline
10/88	Tewksbury	Cyr Oil	Main Street	<2,000 gallons	Gasoline

* Listing is of spills greater than 1,000 gallons.

** Potential or actual impact to the Merrimack River or tributaries.

prevention is preferable to cleanup. Section D of this chapter describes DEP RCRA activities designed to minimize the possibility of future hazardous substance release problems.

C. Site Assessment and Clean Up Activities

The Site Assessment and Cleanup (SAC) section is responsible for assessment and cleanup of hazardous waste 21 E sites. These are sites where a release of oil and/or hazardous material has, or potentially has, occurred.

Hazardous waste sites generally do not directly affect water supplies along the Massachusetts portion of the Merrimack River, according to DEP's best current information. The sites, although large in number, are generally small in impact, causing localized and frequently groundwater problems. Additionally, the potential mass flux of water pollutants, even toxic pollutants, are a small fraction of the pollutant flux to the Merrimack River from other sources discussed in this report, e.g., wastewater treatment plants.

The Northeast Regional Office of the Massachusetts DEP SAC section maintains a listing of all sites under their jurisdiction. The sites are classified under an interim priority system ranging from priority 1 (most serious) to priority 5 (least serious). Priority 1 sites in the Merrimack Basin and tributaries are listed in Appendix H.

While the SAC section does not believe any known site is causing major impact to Merrimack River water quality, the following sites are of potential concern in either a chronic or localized sense.

- Lawrence - Diversitech General (formerly General Tire), DEP Case No. 3-0340 has potentially released significant quantities of PCB oils to on-site canals tributary to the Merrimack River.
- Lowell - Raytheon Company, DEP Case No. 3-0035: high concentrations of volatile halogenated solvents found at facility immediately adjacent to the Concord River.
- Haverhill - Former Haverhill Landfill, DEP Case No. 3-0324: on the banks of the Merrimack, site was known to have accepted significant quantities of hazardous materials. Currently a listed federal Superfund site.
- Ashland - Nyanza Chemical site in Ashland DEP Case No. 3-0216: has heavily contaminated downstream Sudbury River sediments with mercury compounds. This is also a federal Superfund site.
- Tyngsborough- Charles George Landfill, federal Superfund site. In September of 1988 EPA signed a Record of Decision outlining remedial actions which would occur at the site. The actions include capping and leachate treatment.

Both the DEP SAC and ER sections are committed to preventing potential releases and containing actual releases of pollutants to the Merrimack River. As examples of actions, recently booms had been deployed in Lowell to contain an outbreak of petroleum products from the Macheras site (DEP Case No. 3-1620) to prevent adverse impacts to the river. Also, during July of 1989, staff from the SAC section

oversaw the DEP mandated removal of large (160,000 gal.) abandoned underground storage tanks in Lowell on the banks of the Merrimack River (DEP Case No. 3-0354).

D. Resource Conservation and Recovery Act (RCRA) Activities

The Massachusetts Hazardous Waste Management Program, also known as the Massachusetts Resource and Recovery Act (RCRA) Program (operating under the authority of MGL Chapter 21C, the Massachusetts Hazardous Waste Management Act) aims to prevent future contamination of water and other resources by requiring proper management of hazardous wastes produced today.

As a part of this Merrimack River Initiative Program, the RCRA section of the DEP Northeast Regional Office has inspected 93 facilities in the Merrimack Valley, as summarized in Table 8. A listing of the companies inspected and the types of items checked during an inspection is listed in Appendix I. Conditions which are thought to pose a threat to public health, safety, welfare, or the environment are attended to immediately by DEP. The industry's monthly waste generation rates dictate the degree of regulatory compliance required.

Table 8 reveals that a large number of inspections show initial RCRA violations. Very few inspections actually reveal illegal dumping or disposal of hazardous waste. More often, a company has a contract with a waste disposal company and, beyond that, has limited knowledge of the additional requirements of the hazardous waste regulations. Violations vary, but a large percentage involve the hazardous waste accumulation areas, such as a failure to properly mark containers. Other violations can involve such things as failures to prepare a Personnel Training Plan and/or Contingency Plan.

It should be noted that the RCRA program is limited to hazardous "waste" material. Thus, oils or hazardous materials which are not wastes, e.g., fresh oils stored in tanks near the river, are not subject to RCRA regulations or inspections.

In general, the Massachusetts RCRA program is good insurance against future surface and ground water problems.

TABLE 8

RCRA Inspections Performed

Merrimack River Initiative

Town	Inspections	Initial Violations	EEA*
Amesbury	5	5	--
Andover	12	12	--
Boxford	1	0	--
Chelmsford	3	3	--
Dracut	2	2	--
Georgetown	1	1	--
Groveland	0	--	--
Haverhill	8	7	1
Lawrence	15	11	--
Lowell	18	13	1
Merrimack	0	--	--
Methuen	8	8	--
Newbury	0	--	
Newburyport	11	9	1
North Andover	5	4	--
Salisbury	4	3	2
Tewksbury	0	--	--
West Newbury	0	--	--

 93

*EEA: Elevated Enforcement Action (Administrative Order, Penalty Assessment, Civil or Criminal, Referral to A.G.)

XI. REFERENCES

- Camp, Dresser and McKee, City of Haverhill, Draft Wastewater Facilities Plan, September, 1986.
- Camp, Dresser and McKee, City of Lowell, Mass, Combined Sewer Overflow Facilities Plan Update, Draft Report and Environmental Information Document," January, 1990.
- Carr, Kenneth. "A Survey of Priority Pollutants in Merrimack and Connecticut River Fish." US Fish and Wildlife Service, Ecological Services, Concord, NH November, 1984.
- Federal Water Pollution Control Administration. Report on Pollution of the Merrimack River and Certain Tributaries - Part II - Stream Studies. 1966.
- Hanley, Nora E. Merrimack River Survey - 1986 - Water Quality Data, Selected Biological Data, Wastewater Discharge Data, and Water Quality Analysis. Massachusetts Department of Environmental Quality Engineering, Division of Water Pollution Control, Technical Services Branch. October, 1987.
- Hartley, Greenwood III et al. Operational Evaluation of the Greater Lawrence Sanitary District. Massachusetts Department of Environmental Quality Engineering, Division of Water Pollution Control, Technical Assistance Section, November 1988.
- Johnson, Arthur S. A Report on the Water Quality Conditions and Pollution Abatement in the Merrimack River Basin in Massachusetts. Massachusetts Department of Environmental Quality Engineering, Division of Water Pollution Control, Technical Services Branch. April, 1985.
- Maietta, Robert. "Technical Memorandum - 1986 Merrimack River Fish Toxics Monitoring." Massachusetts Department of Environmental Quality Engineering, Division of Water Pollution Control, Technical Services Branch. October 6, 1987.
- Merrimack River Basin - A Water Quality Management Plan - Draft. New Hampshire Department of Environmental Services, Water Supply and Pollution Control Division. June, 1989.
- Merrimack River Watershed Protection Initiative - Past, Present, Future. EPA Region I. Water Quality Branch. December, 1987.
- Nuzzo, Robert M. "1986 Study of Merrimack River Macroinvertebrates. Technical Memorandum 86-5", September 26, 1988.
- Reilly, J. Kevin, "Sanitary Surveys, Lowell and Lawrence," Water Supply Branch EPA Region I. September, 1988.
- Roy, Steve P. and Gayle Birck, Road Salts and Water Supplies Best Management Practices, Massachusetts Department of Environmental Quality Engineering, Office of Planning and Program Management, August, 1981.

APPENDICES

APPENDIX A

TABLE A-1

MERRIMACK RIVER BASIN

APPROXIMATE MUNICIPAL POLLUTION ABATEMENT COSTS*

MILLION DOLLARS

<u>Municipality</u>	<u>Grants in Aid</u>		<u>Local Share</u>	<u>Project Cost</u>
	<u>Federal</u>	<u>State</u>		
Amesbury	3.548	0.71	0.473	4.73
Andover	0.264	0.053	0.035	0.352
Chelmsford	0.222	0.044	0.029	0.295
Dracut	8.445	1.69	1.126	11.260
Groveland	2.1	0.420	0.280	2.80
Haverhill	23.962	4.793	3.195	31.95
Lawrence (GLSD)	39.128	7.825	5.217	52.17
Lowell	64.073	12.814	8.543	85.43
Merrimac	5.279	1.056	0.704	7.04
Methuen	9.338	1.868	1.245	12.45
Newburyport	14.812	2.963	1.975	19.75
Salisbury	0.673	0.135	0.090	0.898
Tewksbury	12.330	2.466	1.644	16.440
Tyngsborough	1.736	0.347	0.232	2.315
Total	<u>\$185.91</u>	<u>\$37.18</u>	<u>\$24.79</u>	<u>\$247.88</u>

* 1985 estimates

APPENDIX A (continued)

TABLE A-2

MERRIMACK RIVER BASIN

APPROXIMATE WATER SUPPLY TREATMENT SYSTEM COSTS

MILLION DOLLARS

<u>Municipality</u>	<u>State Grant</u>	<u>Project Cost</u>
Lowell	5.5	11.55
Tewksbury	4.0	8.40
Andover	6.95	14.6
Methuen	4.69	9.85
Total	\$ 21.14	\$ 44.40

APPENDIX B

GEOGRAPHIC INFORMATION SYSTEM (GIS)

Geographic Information Systems (GIS) are the computer hardware and software that handle geographic or spatially referenced data. Maps can be generated incorporating environmental and natural resource features, and these features can be overlaid and manipulated. The use of GIS for environmental protection is in its very early stages, but the system seems to be potentially valuable. Numerous agencies within the Commonwealth of Massachusetts, as well as Federal agencies such as the EPA and U.S. Geological Survey (U.S.G.S.), are involved in entering and manipulating data in the GIS System.

As a part of the Merrimack River project a great deal of effort was involved in accurately locating environmentally significant features in the Merrimack River basin. This information, which is now field verified and available for the Merrimack River in the Massachusetts GIS System, includes water supply location (both groundwater and surface water), major NPDES permittee locations, groundwater discharge locations, combined sewer overflows locations, and DEP Technical Services Branch (TSB) sampling locations. Other layers, such as hazardous waste site locations in the DEP Northeast Region, are under development.

Other features available statewide include drainage basin and stream layers, town boundary layers, lake layers, some aquifer layers, some land use layers, and some roadway layers.

In addition, the DEP TSB Merrimack River sampling data collected since 1986 are available on the computerized database dBase. These dBase files can be linked to the sampling locations in the GIS system to produce visual, geographical representations of river sampling data.

In the original scope of this Merrimack Initiative project, GIS work was of a fairly high priority; so, considerable effort was expended on it. However, as the project evolved, we found the GIS system was difficult to use and of limited utility in this situation. The GIS may be more useful with groundwater related projects.

Examples of maps generated with the Merrimack GIS data are presented in Figures B-1 through B-4.

71

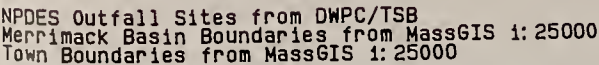


Figure B-1

GIS Generated
Merrimack River Water Supplies
and NPDES Permits

Merrimack River System

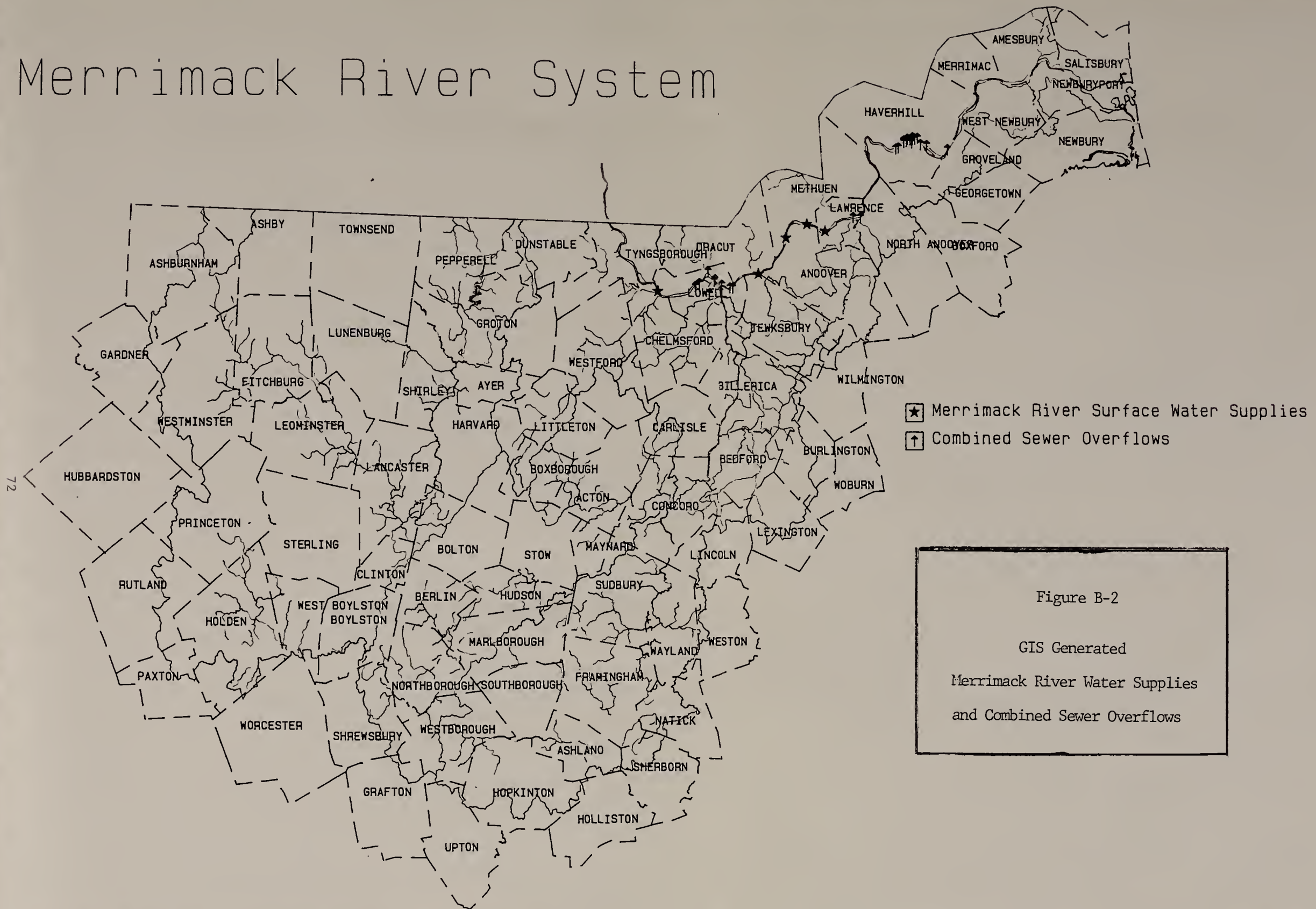


Figure B-2

GIS Generated
Merrimack River Water Supplies
and Combined Sewer Overflows

Merrimack River System

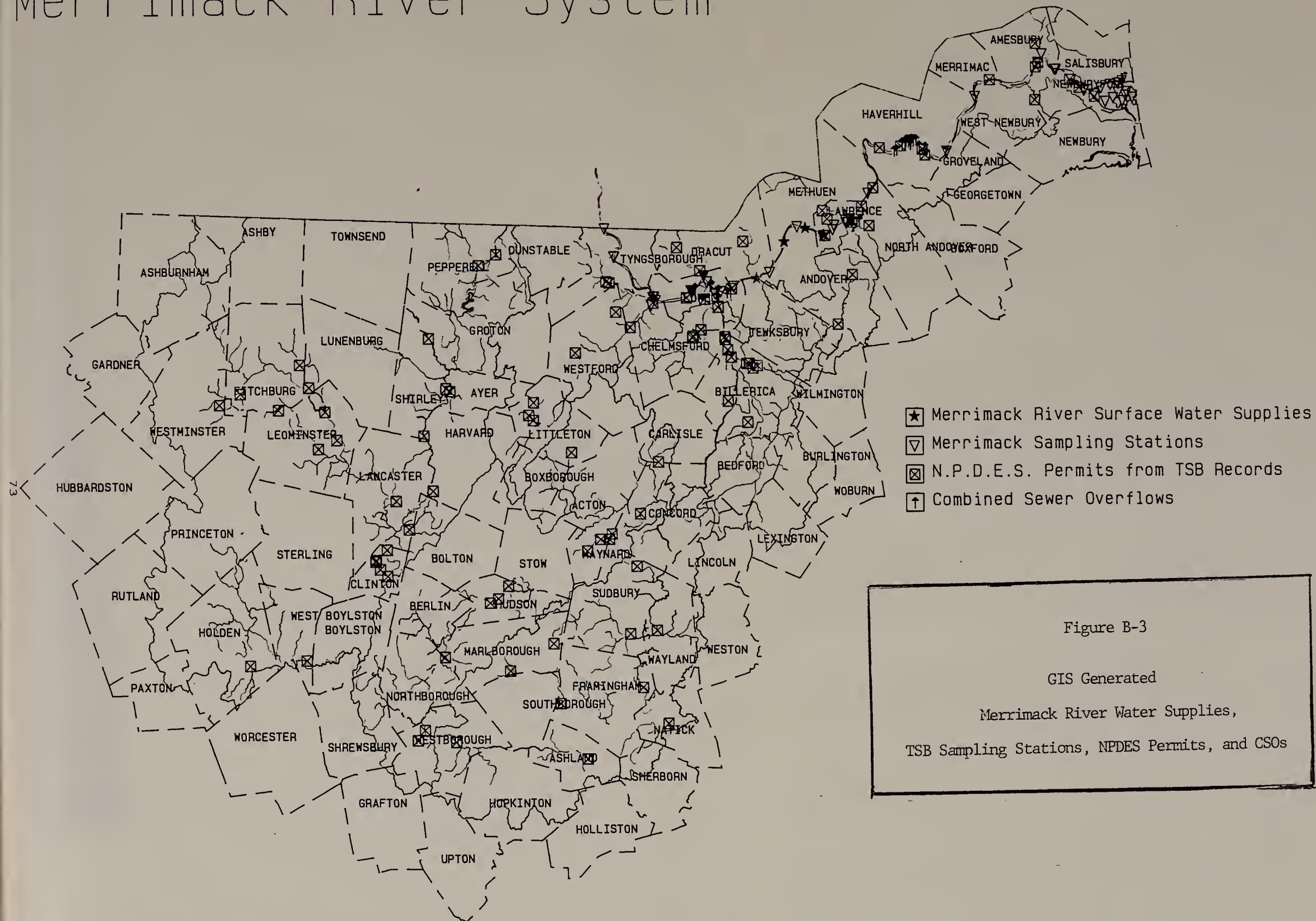
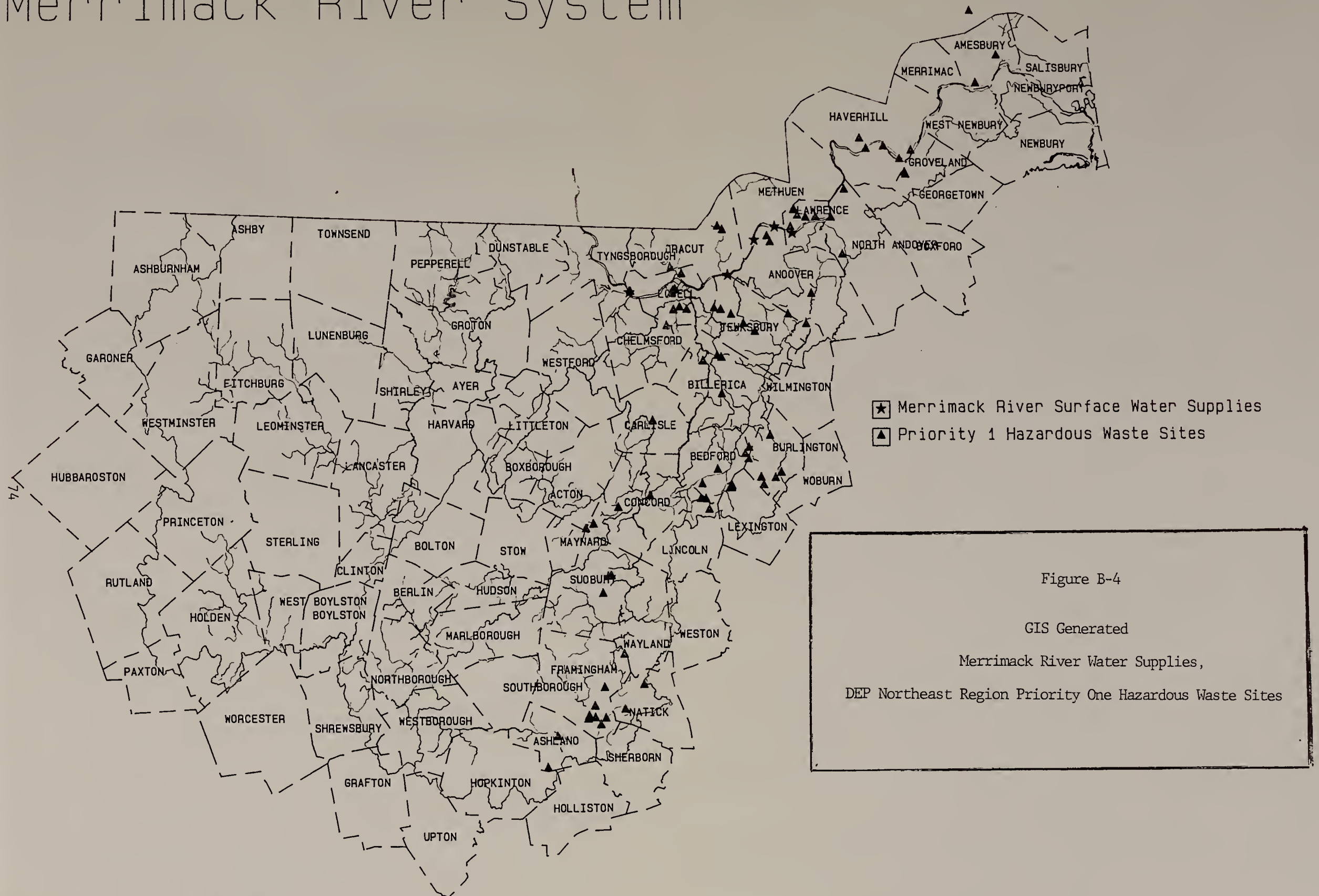


Figure B-3

GIS Generated
Merrimack River Water Supplies,
TSB Sampling Stations, NPDES Permits, and CSOs

Merrimack River System





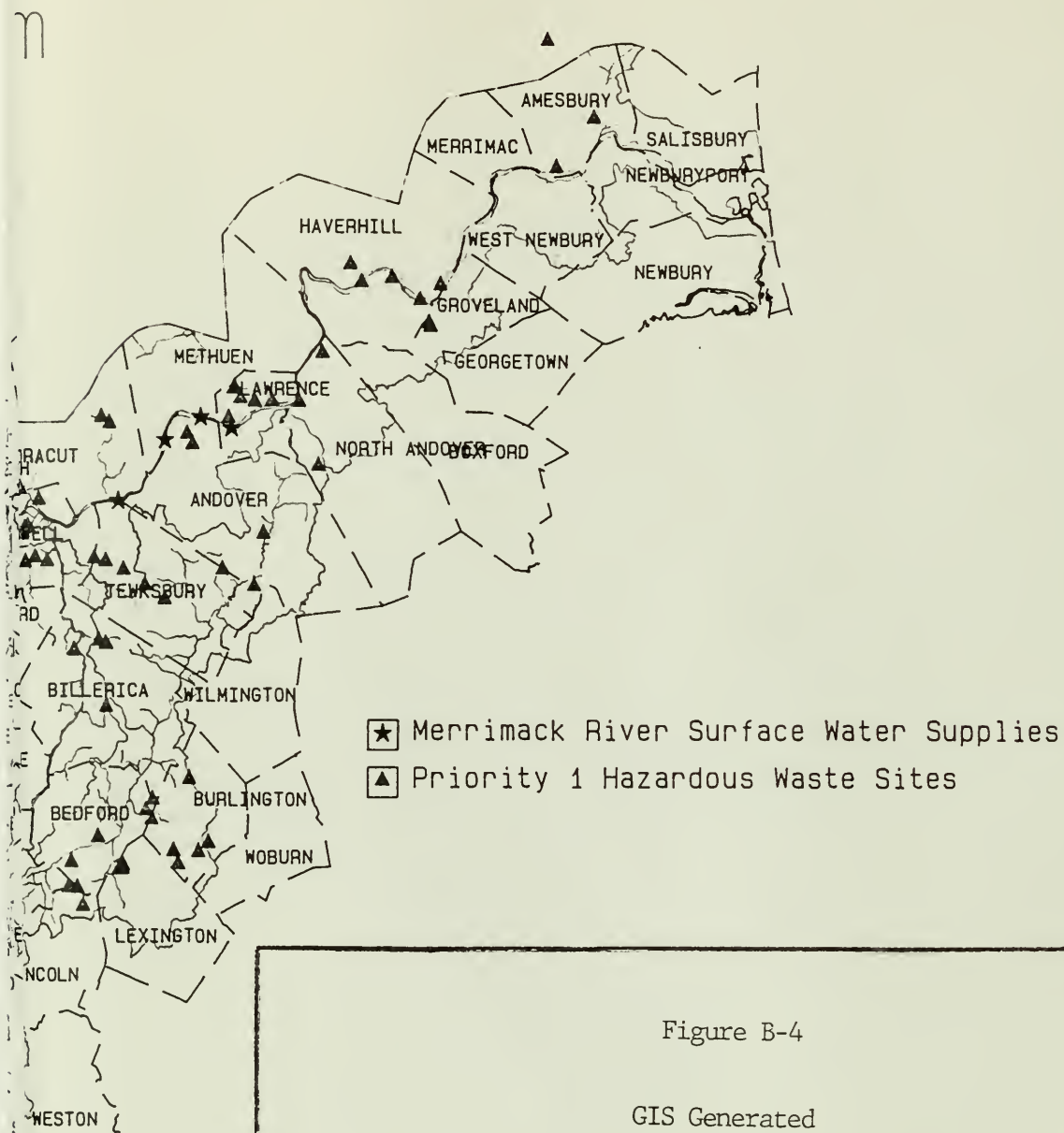


Figure B-4

GIS Generated
Merrimack River Water Supplies,
DEP Northeast Region Priority One Hazardous Waste Sites

APPENDIX C

Commonwealth of Massachusetts

Water Resources Commission

Division of Water Pollution Control

MASSACHUSETTS SURFACE WATER QUALITY STANDARDS

4.01: GENERAL PROVISION

(1) Title. These regulations shall be known as the "Massachusetts Surface Water Quality Standards."

(2) Organization of Standards. These standards comprise five units: General Provisions (314 CMR 4.01), Application of Standards (314 CMR 4.02), Water Quality Criteria (314 CMR 4.03), Antidegradation Provisions (314 CMR 4.04), and Basin Classification and Maps (314 CMR 4.05).

(3) Authority. The Massachusetts Surface Water Quality Standards are adopted by the Division pursuant to the provisions of M.G.L. c.21, S27.

(4) Purpose. The Massachusetts Act charges the Division with the duty and responsibility to enhance the quality and value of the water resources of the Commonwealth and directs the Division to take all action necessary or appropriate to secure to the Commonwealth the benefits of the Federal Act. The objective of the Federal Act is the restoration and maintenance of the chemical, physical and biological integrity of the Nation's waters. To achieve the foregoing requirements the Division has adopted these standards which designate the uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected; which prescribe the water quality criteria required to sustain the designated uses; and which contain regulations necessary to achieve the designated uses and maintain existing water quality including, where appropriate, the prohibition of discharges.

(5) Definitions. As used in these standards, the following words have the following meanings:

Artificial conditions - Those conditions resulting from human alteration of the chemical, physical or biological integrity of waters.

Beneficial use - Any use not impairing the most sensitive use designated in the classification tables contained in 314 CMR 4.05; except that in no case shall the assimilation or transport of pollutants be deemed a beneficial use.

Cold water fishery - Waters whose quality is capable of sustaining a year-round population of cold water trout (salmonidae).

PUBLICATION: #15,303-12-100-3-88-CR-100-4-88-CR Second Printing Approved by Ric Murphy, State Purchasing Agent

Division - The Massachusetts Division of Water Pollution Control, as established by General Laws c.21, S26.

Discharge - Any addition of any pollutant to the waters of the Commonwealth.

EPA - The United States Environmental Protection Agency.

Federal Act - The Federal Water Pollution Control Act, as amended, 33 U.S.C. SS1251, et seq.

Massachusetts Act - The Massachusetts Clean Waters Act, as amended, General Laws, c.21, SS26-53, inclusive.

Pollutant - Any element or property of sewage, agricultural, industrial or commercial waste, runoff, leachate, heated effluent, or other matter, in whatever form and whether originating at a point or major nonpoint source, which is or may be discharge, drained or otherwise introduced into any sewerage system, treatment works or waters of the Commonwealth.

Primary contact recreation - Any recreation or other water use, such as swimming and water skiing, in which there is prolonged and intimate contact with the water sufficient to constitute a health hazard.

Seasonal cold water fishery - Waters whose quality is capable of sustaining only an extremely limited cold water population on a year-round basis, with cold water fish in these streams provided largely by stocking.

Secondary contact recreation - Any recreation or other water use in which contact with the water is either incidental or accidental, such as fishing, boating and limited contact incident to shoreline activities.

Segment - A finite portion of a water body established by the Division for the purpose of classification.

Surface Waters - All waters other than ground waters within the jurisdiction of the Commonwealth, including without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands and coastal waters.

Warm water fishery - Waters whose quality is not capable of sustaining a year-round cold water or seasonal cold water fishery.

Waters of the Commonwealth - All waters within the jurisdiction of the Commonwealth, including, without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands, coastal waters, and ground waters.

(6) Severability. If any provision of these standards is held invalid, the remainder of these standards shall not be affected thereby.

4.02: APPLICATION OF STANDARDS

(1) Establishment of Effluent Limitations. In regulating discharges of pollutants to surface waters, the Division will limit or prohibit such discharges to insure that the water quality standards of the receiving waters will be maintained or attained. The determination by the Division of the applicable level of treatment for an individual discharger will be made in the

establishment of effluent limitations in the individual discharge permits in accordance with 314 CMR 3.10(3), (4), (5) and (6). In establishing water quality based effluent limitations, the Division must consider natural background conditions, existing discharges, must protect existing downstream uses, and must not interfere with the maintenance and attainment of beneficial uses in downstream waters. Toward this end, the Division may provide a reasonable margin of safety to account for any lack of knowledge concerning the relationship between the pollutants being discharged and their impact on the quality of the receiving waters.

(2) Mixing Zones. In applying these standards, the Division may recognize, where appropriate, a limited mixing zone or zone of initial dilution on a case-by-case basis. The location, size and shape of these zones shall provide for the maximum protection of aquatic resources. At a minimum, mixing zones must:

- a) Meet the criteria for aesthetics;
- b) Be limited to an area or volume that will minimize interference with the designated uses or established community of aquatic life in the segment;
- c) Allow an appropriate zone of passage for migrating fish and other organisms; and
- d) Not result in substances accumulating in sediments, aquatic life or food chains to exceed known or predicted safe exposure levels for the health of humans or aquatic life.

(3) Hydrologic Conditions. The Division will determine the most severe hydrologic condition at which water quality standards must be met. In classifying the inland surface waters and in applying these standards to such waters, the critical low flow condition at and above which these standards must be met is the average minimum consecutive seven-day flow to be expected once in ten years, unless otherwise stated by the Division in these standards. In artificially regulated waters, the critical low flow will be established by the Division through agreement with the Federal, state or private interest controlling the flow. The minimum flow established in such agreement will become the critical low flow under this section for those waters covered by the agreement.

(4) Procedures for Sampling and Analysis. For the purpose of collecting, preserving and analyzing samples in connection with these water quality standards, the fifteenth edition of Standard Methods of the Examination of Water and Wastewater published by the American Public Health Association, or Methods for Chemical Analysis of Water and Wastes published by the U.S. Environmental Protection Agency should be used. Where a method is not given in these publication, the latest procedures of the American society for Testing Materials (ASTM) shall be used, or any other equivalent method approved by the Director.

4.03: MINIMUM WATER QUALITY CRITERIA AND ASSOCIATED USES

(1) Description of Contents. 314 CMR 4.03 sets forth the Classes to be used by the Division in classifying the surface waters according to the uses

for which the waters shall be enhanced, maintained and protected. For each class, the most sensitive beneficial uses are identified and minimum criteria for water quality in the water column are established. In interpreting and applying the minimum criteria in 314 CMR 4.03(4), the Division shall consider local conditions including, but not limited to:

- a) the characteristics of the biological community;
- b) temperature, weather, flow, and physical and chemical characteristics; and
- c) synergistic and antagonistic effects of combinations of pollutants.

(2) Coordination with Federal Criteria. The Division will use EPA criteria established pursuant to Section 304(a)(1) of the Federal Act as guidance in establishing case-by-case discharge limits for pollutants not specifically listed in these standards but including under the heading "Other Constituents" in 314 CMR 4.03(4), for identifying bioassay application factors and for interpretations of narrative criteria. Where the minimum criteria specifically listed by the Division in this part differ from those contained in the federal criteria, the provisions of the specifically listed criteria in these standards shall apply.

(3) Classes and Designated Uses. The surface waters will be assigned to one of the classes listed below. Each class is defined by the most sensitive, and therefore governing, uses which it is intended to protect. The classes are:

Classes for Inland Waters

Class A - Waters assigned to this class are designated for use as a source of public water supply.

Class B - Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; and for primary and secondary contact recreation.

Class C - Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; and for secondary contact recreation.

Classes for Coastal and Marine Waters

Class SA - Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; for primary and secondary contact recreation; and for shellfish harvesting without depuration in approved areas.

Class SB - Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; for primary and secondary contact recreation; and for shellfish harvesting with depuration (Restricted Shellfish areas).

Class SC - Waters assigned to this class are designated for the protection and propagation of fish, other aquatic life and wildlife; and for secondary contact recreation.

(4) Minimum Criteria. The following minimum criteria are adopted and shall be applicable to all surface waters.

- A. These minimum criteria are applicable to all waters of the Commonwealth, unless criteria specified for individual classes are more stringent.

<u>Parameter</u>	<u>Criteria</u>
1. Aesthetics	All waters shall be free from pollutants in concentrations or combinations that: a) Settle to form objectionable deposits; b) Float as debris, scum or other matter to form nuisances; c) Produce objectionable odor, color, taste or turbidity; or, d) Result in the dominance of nuisance species.
2. Radioactive Substances	Shall not exceed the recommended limits of the United States Environmental Protection Agency's National Drinking Water Regulations.
3. Tainting Substances	Shall not be in concentrations or combinations that produce undesirable flavors in the edible portions of aquatic organisms.
4. Color, Turbidity, Total Suspended Solids	Shall not be in concentrations or combinations that would exceed the recommended limits on the most sensitive receiving water use.
5. Oil and Grease	The water surface shall be free from floating oils, grease and petrochemicals and any concentrations or combinations in the water column or sediments that are aesthetically objectionable or deleterious to the biota are prohibited. For oil and grease of petroleum origin the maximum allowable discharge concentration is 15 mg/l.
6. Nutrients	Shall not exceed the site-specific limits necessary to control accelerated or cultural eutrophication
7. Other Constituents	Waters shall be free from pollutants in concentrations or combinations that: a) Exceed the recommended limits on the most sensitive receiving water uses; b) Injure, are toxic to, or produce adverse physiological or behavioral responses in

- humans or aquatic life; or,
c) Exceed site-specific safe exposure levels determined by bioassay using sensitive species.

B. Inland Waters - the following additional minimum criteria are applicable to inland water classifications.

For Class A waters:

<u>Parameter</u>	<u>Criteria</u>
1. Dissolved Oxygen	Shall be a minimum of 5.0 mg/l in warm water fisheries and a minimum of 6.0 mg/l in cold water fisheries.
2. Temperature	Shall not exceed 83°F (28.3°C) in warm water fisheries or 68°F (20°C) in cold water fisheries nor shall the rise resulting from artificial origin exceed 4.0°F (2.2°C).
3. pH	As naturally occurs.
4. Total Coliform Bacteria	Shall not exceed a log mean for a set of samples of 50 per 100 ml during any monthly sampling period.
5. Turbidity	None other than of natural origin.
6. Total Dissolved Solids	Shall not exceed 500 mg/l.
7. Chlorides	Shall not exceed 250 mg/l.
8. Sulfates	Shall not exceed 250 mg/l.
9. Nitrate	Shall not exceed 10 mg/l as nitrogen.

For Class B waters: (Merrimack River - freshwater portion)

<u>Parameter</u>	<u>Criteria</u>
1. Dissolved Oxygen	Shall be a minimum of 5.0 mg/l in warm water fisheries and a minimum of 6.0 mg/l in cold water fisheries.
2. Temperature	Shall not exceed 83°F (28.3°C) in warm water fisheries or 68°F (20°C) in cold water fisheries, nor shall the rise resulting from artificial origin exceed 4.0°F (2.2°C).
3. pH	Shall be in the range of 6.5-8.0 standard units and not more than 0.2 units outside of the naturally occurring range.

4. Fecal Coliform Bacteria Shall not exceed a log mean for a set of samples of 200 per 100 ml, nor shall more than 10% of the total samples exceed 400 per 100 ml during any monthly sampling period, except as provided by 310 CMR 4.02(1).

Appendix D

NPDES Permit Listing - Merrimack River System

	FACILITY	CITY	NPDESNO	RECWATER	MAJMIN *
1	303 BALLARDVALE STREET	WILMINGTON	MA0029807	SHAWSHOEN RIVER	
2	3M COMPANY PLANT	CHELMSFORD	MA0025097	HALE BROOK	
3	495/3 TECH CENTER TREATMENT PL	CHELMSFORD	MA0029289	RIVER MEADOW BROOK WETLANDS	
4	ADVANCE COATINGS CO	WESTMINSTER	MA0024686	NASHUA RIVER	M
5	AERODYNE RESEARCH, INC.	BILLERICA	MA0027804	NUTTING LAKE TO	
6	ALDEN RESEARCH LABORATORY	HOLDEN	MA0028801	CHAFFINS BROOK	
7	ALLEN DRIVE SUBDIVISION	SALISBURY	MA0025780	WOODSIDE BROOK	
8	AMERICAN DEVELOPMENT CORP. INC	MARLBOROUGH	MA0031577	UNNAMED DITCH TO HOP BROOK-	
9	AMESBURY	AMESBURY	MA0101745	MERRIMACK & BACK RIVERS	M
10	AMESBURY W T P	AMESBURY	MA0102822	POW WOW RIVER	
11	AMIDON BROTHERS CIDER CO.	STERLING	MA0028509	QUAG-SWAMP VIA MDC DITCH	
12	ANDOVER COMPANIES	ANDOVER	MA0031399	MERRIMACK RIVER-WEST OUTFAL	
13	ARMY NATIONAL GUARD/OMS#7	FRAMINGHAM	MA0030279	GROUND DISCHARGE	
14	ASHLAND SAND & STONE COMPANY	ASHLAND	MA0000132	SUDBURY RIVER	
15	ASTRA PHARMACEUTAL PRODUCTS,IN	WESTBOROUGH	MA0027189	HOCOMONCO POND	
16	AT&T	NORTH ANDOVER	MA0001261	MERRIMACK RIVER	M
17	AVCO SPECIALTY MATERIALS/TEXTR	LOWELL	MA0031429	RIVER MEADOW BROOK	
18	AVCO SPECIALTY MATERIALS/TEXTR	LOWELL	MA0031674	BLACK BROOK	
19	AYER WTF	AYER	MA0100013	NASHUA RIVER	M
20	B & M NO. BILLERICA MAINT. FAC	NORTH BILLERICA	MA0030058	NO NAME BROOK	
21	BAYSTATE ABRASIVES	WESTBOROUGH	MA0000108	RUTTERS BROOK	
22	BEDFORD:MUNICIPAL WELLS NOS. 7	BEDFORD	MA0102628	SHAWSHOEN RIVER	
23	BILLERICA JAIL AND HOUSE OF CO	BILLERICA	MA0102563	CONCORD RIVER	
24	BILLERICA-LETCHWORTH AVE WTP	BILLERICA	MA0101711	CONCORD RIVER	M
25	BIXBY INTERNAT CORP	HAVERHILL	MA0026310	MERRIMACK RIVER	
26	BIXBY INTERNATIONAL CORP	NEWBURYPORT	MA0025186	MERRIMACK RIVER	
27	BOOTT MILLS	LOWELL	MA0005720	LOWER PAWTUCKET	
28	BOSTON & MAINE-FITCHBURG	LUNENBURG	MA0003581	BAKER BROOK	
29	BOURBEAU ESTATES	NEWBURYPORT	MA0029904	ARTICHOKE RIVER	
30	BTL SPECIALTY RESINS CORP.	ANDOVER	MA0004952	SHAWSHOEN RIVER	
31	CAMBRIDGE BIOSCIENCE CORP.	HOPKINTON	MA0028797	NORTH POND	
32	CARE CLEANERS	CHELMSFORD	MA0022390	BEAVER BROOK	
33	CERES CORPORATION	BILLERICA	MA0031763	CONCORD RIVER	
34	CHELMSFORD LAUNDROMAT	CHELMSFORD	MA0022438	MEADOW BROOK TRIB	
35	CLINTON (T) BYPASS	CLINTON	MA0100391	NPR--DENIAL OF APPLICATION	
36	COLORCRAFT CORPORATION	FITCHBURG	MA0000221	NASHUA RIVER-BAKER BROOK	
37	COMPO INDUSTRIES INC.	LOWELL	MA0001864	PAWTUCKET CANAL	
38	CONCORD	CONCORD	MA0100668	CONCORD RIVER	M
39	CONCORD CORRECTIONAL INST	CONCORD	MA0102245	CONCORD RIVER	
40	CORENCO DIV. OF BAKER COMODITI	TEWKSBURY	MA0031585	CONCORD RIVER	
41	CUSHING ACADEMY	ASHBURNHAM	MA0101958	NASHUA RIVER	
42	DELTA SUPRENANT WIRE AND CABLE	CLINTON	MA0001783	RIGBY BROOK	M
43	DENNISON MANUFACTURING CO.	FRAMINGHAM	MA0002844	BEAVER DAM BROOK	
44	DIGITAL EQUIPMENT CO	MAYNARD	MA0022144	ASSABET RIVER	
45	DIVERSITECH GENERAL INC.	LAWRENCE	MA0003824	SPICRET RIVER	
46	DOREEN BRUSH COMPANY	LEOMINSTER	MA0003271	NASHUA RIVER	
47	DRACUT	DRACUT	MA0101184	MERRIMACK RIVER	
48	E.B.KINGMAN CO.	LEOMINSTER	MA0027405	MONOOSNOCK BROOK	
49	EASTERN MFG. CORP. PLT #1	AMESBURY	MA0031461		
50	ECC CORP	HOLDEN	MA0022799	ASNEBUMSKIT BROOK	
51	EXXON COMPANY, USA	DRACUT	MA0022225	MERRIMACK RIVER	M
52	FENWAL INCORPORATED	ASHLAND	MA0000973	COLD SPRING BRK	
53	FIRST BANK	LOWELL	MA0030741	RIVER MEADOW BROOK VIA STRE	
54	FITCHBURG, EAST WWTP	FITCHBURG	MA0100986	NASHUA RIVER	M
55	FLETCHER GRANITE CO., INC.	WESTFORD	MA0020231	STONY BROOK	
56	GENERAL ELECTRIC CO-FITCHBURG	FITCHBURG	MA0029815	NASHUA RIVER	

57	GENERAL ELECTRIC-LOWELL PLT	LOWELL	MA0003883	MERRIMACK RIVER	
58	GENERAL LATEX & CHEMICAL CORP	BILLERICA	MA0004529	OPEN DITCH	M
59	GENERAL MOTORS CORP	FRAMINGHAM	MA0003808	BEAVER DAM BRK	
60	GOULD INC.	NEWBURYPORT	MA0000281	MERRIMACK RIVER	M
61	GREATER LAWRENCE SD	NORTH ANDOVER	MA0100447	MERRIMACK RIVER	M
62	GROVELAND	GROVELAND	MA0102661	BRINDLE BROOK & JOHNSONS CR	
63	HAVERHILL PAPERBOARD CO	HAVERHILL	MA0004049	MERRIMACK RIVER	
64	HAVERHILL WPAF	HAVERHILL	MA0101621	MERRIMACK RIVER	M
65	HIGHWOOD OFFICE & RESEARCH PAR	TEWKSBURY	MA0030210		
66	HOLDEN TRAP ROCK CO, DIV OF MA	HOLDEN	MA0020320	AUSTIN BROOK	
67	HOLLINGSWORTH & VOSE CO.	GROTON	MA0004561	SQUANNA COOK RIVER	M
68	HUDSON WWTF	HUDSON	MA0101788	ASSABET RIVER	M
69	INDUSTRIAL SCHOOL FOR GIRLS	LANCASTER	MA0025429	SEPTIC TANK	
70	J MELONE & SONS INC	STOW	MA0025984	STOW BROOK	
71	JAMES RIVER-MASS/OTIS DIVISION	FITCHBURG	MA0004448	NASHUA-WHITMAN	
72	JAMES RIVER-PEPPERELL, INC.	EAST PEPPERELL	MA0005185	NASHUA RIVER	M
73	KENICS CORP.	NORTH ANDOVER	MA0002496	COCHICHEWICK BROOK	
74	LEOMINSTER	LEOMINSTER	MA0001813	MONOOSNOCK BROOK	
75	LEOMINSTER DPW	LEOMINSTER	MA0100617	NASHUA RIVER NORTH	M
76	LIQUID CARBONIC CORP.	TEWKSBURY	MA0002135	SHAWSHEEN RIVER	
77	LOWELL MSS	LOWELL	MA0100633	MERRIMACK RIVER	M
78	MAJILITE MANUFACTURING INC.	LOWELL	MA0032506	MEADOW BROOK RIVER	
79	MARLBOROUGH STP (EAST)	MARLBOROUGH	MA0100498	HOP BROOK	M
80	MARLBOROUGH WESTERLY WTF	MARLBOROUGH	MA0100480	ASSABET RIVER	M
81	MASSACHUSETTS MICROELECTRONICS	WESTBOROUGH	MA0030465	ASSABET RIVER	
82	MAYNARD STP	MAYNARD	MA0101001	ASSABET RIVER	M
83	MBTA - B & M LOCOMOTIVE REPAIR	NORTH BILLERICA	MA0028614		
84	MCI SHIRLEY	SHIRLEY	MA0032824	NASHUA RIVER	
85	MERRIMAC	MERRIMAC	MA0101150	COBBLERS BR & MERRIMACK R	
86	MERRIMAC PAPER COMPANY INC	LAWRENCE	MA0001945	MERRIMACK RIVER	
87	METHUEN	METHUEN	MA0102971	MERRIMACK RIVER	
88	MI-LOR CORP	LEOMINSTER	MA0000370	FALL BROOK	
89	MIDDLESEX SCHOOL	CONCORD	MA0102466	SPENCER BROOK VIA UNNAMED T	
90	MILLIPORE CORP	BEDFORD	MA0025828	VINE BROOK	
91	MITRE CORPORATION	BEDFORD	MA0027197	VINE BROOK TRIB	
92	MWRA-CLINTON FACILITY	CLINTON	MA0100404	NASHUA RIVER, SOUTH BR	M
93	NEWBURYPORT WATER TP	NEWBURYPORT	MA0023094	MERRIMACK RIVER	
94	NEWBURYPORT WPCF	NEWBURYPORT	MA0101427	MERRIMACK RIVER	M
95	NO-TOWN FILTRATION PLANT	LEOMINSTER	MA0024759	MONOOSNOCK BROOK	
96	NORDBLOM MANAGEMENT CORP.	WESTBOROUGH	MA0030678	STORMWATER DISCHARGE	
97	NORTH BILLERICA CO.	BILLERICA	MA0004189	CONCORD RIVER	
98	NYE'S JAPENAMELAC CORPORATION	CHELMSFORD	MA0003077	STONY BROOK	M
99	OLD COLONY PETROLEUM CO.	AMESBURY	MA0031941	POWOW RIVER	
00	OLD TOWN VILLAGE APARTMENTS	AYER	MA0031411	DAY BROOK TRIBUTARY-FLANAGA	
01	P. J. KEATING, CO.	LUNENBURG	MA0003689	BOW BROOK	
02	PARIS REALTY	SUDBURY	MA0030171	SUDBURY RIVER VIA DITCH	
03	PENN CULVERT COMPANY	NORTH BILLERICA	MA0030147	MIDDLESEX CANAL	
04	PENTUCKET REGNL SCHOOL DISTRIC	WEST NEWBURY	MA0102539	MERRIMACK RIVER	
05	PEPPERELL	PEPPERELL	MA0100064	NASHUA RIVER	
06	PEPPERELL POWER ASSOCIATES	PEPPERELL	MA0032034	NASHUA RIVER. JAMES RIVER W	
07	PHEASANT LANE MALL	TYNGSBOROUGH	MA0030597	MERRIMACK RIVER VIA TRIBUTA	
08	PLASTIC COMPOUNDERS OF MASS.	HAVERHILL	MA0026301	HAVERILL STORM SEWER	
09	POINT WEST OFFICE CENTER	FRAMINGHAM	MA0030635	SUDBURY RIVER	
10	POINT WEST PLACE	FRAMINGHAM	MA0030716	SUDBURY RIVER VIA CROOKED B	
11	POLYSAR INCORPORATED	LEOMINSTER	MA0000442	WASS BROOK	M
12	QUINN-PERKINS SAND & GRAVEL, I	BURLINGTON	MA0004081	BUTTERFIELD PND	
13	RAYTHEON CO-BEDFORD LABORATORY	BEDFORD	MA0001406	ELM BROOK	
14	RAYTHEON CO-WAYLAND LAB	WAYLAND	MA0001511	SUDBURY RIVER	M
15	RAYTHEON CORPORATION	BILLERICA	MA0001414	CONCORD RIVER	M
16	REFUSE FUELS ASSOCIATES	LAWRENCE	MA0027626	SPICKETT RIVER	

117	RIVER ROAD INDUSTRIAL PARK	HUDSON	MA0030198		
118	RIVER TERRACE HEALTHCARE	LANCASTER	MA0025763	NASHUA RIVER,NORTH BR	
119	SALISBURY	SALISBURY	MA0025038	BLACK ROCKS CREEK	
120	SALISBURY SEWER COMMISSION	SALISBURY	MA0102873	MERRIMACK RIVER	M
121	SEARSTOWN MALL	LEOMINSTER	MA0030562		
122	SHAWSHEEN RUBBER COMPANY	ANDOVER	MA0026271	SHAWSHEEN RIVER	
123	SHREWBURY RESIDUE LANDFILL	SHREWSBURY	MA0029785	WETLANDS	
124	SILICON TRANSISTOR CORP	CHELMSFORD	MA0025241	BEAVER BROOK	M
125	SIMONDS CUTTING TOOLS	FITCHBURG	MA0022896	NASHUA RIVER	
126	SPERRY RESEARCH CENTER		MA0030155		
127	ST. BENEDICT CENTER	STILL RIVER	MA0028444	NASHUA RIVER	
128	STATE PROPERTIES OF N.E.	ACTON	MA0028835	ASSABET RIVER	
129	STICKNEY & POOR SPICE COMPANY	CHELMSFORD	MA0027693	MEADOW BROOK	
130	SUPERIOR PRINTING INK COMPANY	MARLBOROUGH	MA0029513	SUDBURY RESERVOIR VIA TRIBU	
131	TEWKSBURY DPW	TEWKSBURY	MA0102954	MERRIMACK RIVER	
132	TEWKSBURY HOSPITAL	TEWKSBURY	MA0030040		
133	THE KELLY COMPANY	CLINTON	MA0027448	COUNTERPANE BROOK	
134	THE MILL	NORTH CHELMSFORD	MA0029572	STONY BROOK	
135	TILTON & COOK CO.	LEOMINSTER	MA0026352	MONOOSNOCK BROOK	
136	TIMEX CLOCK CO	ASHLAND	MA0003841	SUDBURY RIVER	
137	TUCKER HOUSEWARES	LEOMINSTER	MA0005142	NASHUA RIVER	
138	TYER INDUSTRIES INC.	ANDOVER	MA0026972	SHAWSHEEN RIVER	
139	UNION CARBIDE CORP	SUDBURY	MA0004499	WASH BROOK	
140	US ARMY NATICK R & D LABS	NATICK	MA0001724	LAKE COCHITUATE	
141	US ARMY-TOPSFIELD HOUSING STP	TOPSFIELD	MA0090808	WENHAM SWAMP (FAR WEST COVE	
142	VALLEY MANUFACTURED PRODUCTS CO	GROVELAND	MA0028461	MERRIMACK RIVER VIA JOHNSON	
143	VERNON PLASTICS	HAVERHILL	MA0002984	UNNAMED BROOK	
144	VERYFINE PRODUCTS, INC.	LITTLETON	MA0004936	MILL BROOK	M
145	W.R.GRACE & COMPANY	ACTON	MA0027421	ASSABET RIVER	
146	WANNALANCIT TEXTILE	LOWELL	MA0022021	MERRIMACK RIVER	
147	WEST FITCHBURG WTF	FITCHBURG	MA0101281	NASHUA RIVER	M
148	WESTBORO ASSOCIATES BUILDING	WESTBOROUGH	MA0030864	SUDBURY RIVER	
149	WESTBOROUGH WTP	WESTBOROUGH	MA0100412	ASSABET RIVER	M
150	WESTFORD ANODIZING	GRANITEVILLE	MA0024414	STONEY BROOK	M
151	WHITMAN-HANSON REGIONAL HS	HANSON	MA0101354	SHUMATCUSCACANT RIVE	
152	WILLIAM TONNER COMPANY	LOWELL	MA0002917	LOWELL LOCK	
153	WILTEC, INC.	LEOMINSTER	MA0028045	UNNAMED BROOK	
154	WITT EQUIPMENT COMPANY	HOPKINTON	MA0027651	NORTH POND	

*Major discharges are indicated by an 'M' in this column.

APPENDIX E

Fathead minnow (Pimephales promelas) larval survival and growth tests and cladoceran (Ceriodaphnia dubia) survival and reproduction tests are seven-day chronic toxicity tests conducted on a daily static renewal basis. Test procedures followed are outlined in the EPA manual "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms" (Weber et al, 1989). The end point in the chronic test is the highest Concentration of sample tested exhibiting No Observed Effects (NOEC) to the test organisms.

The 48-hour acute toxicity tests also involve preparing a series of sample concentrations using a clean-water diluent. Groups of test animals (Pimephales promelas and Daphnia pulex) are then exposed to the test concentrations for a specified time (48-hours). The test procedures followed are outlined in the EPA manual "Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms" (Peltier and Weber, 1985). Mortality data are used to calculate the LC_{50} , the lethal concentration of the effluent to 50 percent of the test organisms, and the NOAEL, the No Observable Acute Effect Level which corresponds to the highest test effluent concentration causing ten percent or less mortality.

The MicrotoxTM Toxicity Analyzer system uses freeze-dried luminescent bacteria as its test organisms. When rehydrated, these bacteria emit light. To test a water sample for toxicity using MicrotoxTM, an analyst prepares a series of dilutions of the sample and exposes them to the rehydrated bacteria. The light intensity of each sample dilution is measured at preselected time intervals over a 30-minute period and compared with that of a control (bacteria only). It is assumed that changes in light intensity are due to toxicant interference with the biochemical reaction that produces light. Toxicity is then measured as the percent decrease in light intensity of each of the sample dilutions compared with that of the control. The tests were conducted in accordance with the procedures outlined in the MicrotoxTM System Operating Manual (Beckman, Inc., 1982).

Appendix E

TABLE E-1

MAIN STEM MERRIMACK RIVER DISCHARGE

TOXICITY ASSESSMENT

PERMITTEE	RECEIVING WATER	TEST RESULT *	RWC	PASS/FAIL
Amesbury POTW	Merrimack River	NOEC = 50%	0.25%	P
AT&T North Andover	Merrimack River	NOEC = 100% EC ₅₀ = 62%	0.17%	P P
Greater Lawrence Sanitary District	Merrimack River	NOEC = 25% EC ₅₀ = >100% LC ₅₀ = >100%	4.4%	P P P
Haverhill POTW	Merrimack River	NOEC = 100% LC ₅₀ = >100%	1.7%	P P
Lowell POTW	Merrimack River	Invalid NOEC = 100% EC ₅₀ = 78% EC ₅₀ = 19%	3.1%	— P F F
Microfab, Inc. Amesbury	Unnamed trib to Merrimack River	LC ₅₀ = 6.42% (no longer discharges)		
Newburyport POTW	Merrimack River	NOEC = 100%	0.35%	P
Salisbury POTW	Merrimack River	LC ₅₀ = >100%	10%	P

*Test dates and other information compiled in Table E-2.

Appendix E

TABLE E-2

MAIN STEM MERRIMACK RIVER DISCHARGE

TOXICITY TESTING INFORMATION

PERMITTEE	SAMPLING DATE(S)	TEST TYPE	TEST RESULT
Amesbury POTW	8/22, 24, 26/88	7-day <u>C. dubia</u>	NOEC = 50%
AT&T	8/22, 24, 26/88	7-day <u>C. dubia</u>	NOEC = 100%
North Andover	8/12-13/86	Microtox TM	EC ₅₀ = 63%
Greater Lawrence Sanitary District	8/22, 24, 26/88	7-day <u>C. dubia</u>	NOEC = 25%
	7/19-20/87	Microtox TM	EC ₅₀ = >100%
	3/15-16/87	48-hr. <u>D. pulex</u>	LC ₅₀ = >100%
Haverhill POTW	8/22, 24, 26/88	7-day <u>C. dubia</u>	NOEC = 100%
	2/23/87	48-hr. <u>D. pulex</u>	LC ₅₀ = >100%
Lowell POTW	8/22, 24, 26/88	7-day <u>C. dubia</u>	invalid
	9/18, 20, 22/89	7-day <u>C. dubia</u>	NOEC = 100%
	6/17-18/86	Microtox TM	EC ₅₀ = 78%
	6/12-13/89	Microtox TM	EC ₅₀ = 19%
Microfab, Inc. Amesbury	6/26-27/86	48-hr. <u>D. pulex</u>	LC ₅₀ = 6.42%
Newburyport POTW	8/22, 24, 26/88	7-day <u>C. dubia</u>	NOEC = 100%
Salisbury POTW	10/9-10/89	48-hr. <u>M. bahia</u>	LC ₅₀ = >100%

APPENDIX F

TABLE F-1

LOWELL COMBINED SEWER OVERFLOW STRUCTURES

CSO STRUCTURE	NPDES	
	PERMIT SERIAL NUMBER	RECEIVING WATER
Barrasford Avenue	030(1)-SDS#8	Merrimack River
Beaver Brook	007-SDS#2	Beaver Brook
First Street	012-SDS#5	Merrimack River
Merrimack Street	030(2)	Merrimack River
Read Street	011-SDS#4	Merrimack River
Tilden Street	027-SDS#7	Merrimack River
Walker Street	002-SDS#1	Merrimack River
Warren Street	020-SDS#6	Concord River
West Street	008-SDS#3	Merrimack River

APPENDIX F

TABLE F-2

LAWRENCE COMBINED SEWER OVERFLOW STRUCTURES

OVERFLOW LOCATION	NPDES PERMIT SERIAL NUMBER	INTERCEPTOR SYSTEM
South Bank - Main Overflow	002	South Bank
South Bank - Secondary Overflow	003	South Bank
North Bank - Main Overflow mouth of Spicket River	004	North Bank
North Bank Secondary Overflow	005	North Bank

APPENDIX F

TABLE F-3

HAVERHILL COMBINED SEWER OVERFLOW STRUCTURES

<u>OVERFLOW LOCATION</u>	<u>NPDES PERMIT SERIAL NUMBER</u>	<u>INTERCEPTOR SYSTEM</u>	<u>OVERFLOW CONDITION</u>
Bates Bridge	001	Riverside Interceptor	Emergency
Boardman Street	010	Lower River Crossing	Emergency
Lower Siphon		Lower River Crossing	Flow Quantity Control
Fire Station	016	Lower River Crossing	Emergency
Main Street	019	Lower River Crossing	Emergency
Little River (Middle Siphon)	021	Middle River Crossing	Flow Quantity Control
R.R. Bridge	022	Upper River Crossing	Emergency
266 River Street	023	Upper River Crossing	Emergency
Upper Siphon		Upper River Crossing	Emergency
Beach Street	025	Upper River Crossing	Emergency
Frontal Street	031	Bradford Interceptor	Flow Quantity Control
Bradford Avenue	032	Bradford Interceptor	Flow Quantity Control
Prospect Street	033	Bradford Interceptor	Flow Quantity Control
Middlesex Street	035	Bradford Interceptor	Flow Quantity Control
Main Street	035	Bradford Interceptor	Flow Quantity Control
Ferry Street	036	Bradford Interceptor	Flow Quantity Control

APPENDIX G

SOLID WASTE SITE INFORMATION

Amesbury

Site: St. Joseph's Cemetery
Location: Jct. Routes 110 and 150
Status: Inactive
Abutting water: Unnamed tributary to Bailey Pond

Leased from the Roman Catholic church, the site was used for the disposal of demolition wastes with the goal of raising the property for use as an expansion of the cemetery. Site was also briefly used for the disposal of ash from the combustion of fossil fuels. Site is not known to be contributing to the contamination of water resources.

Site: Titcum Pit
Location: Jct. Route 150 and Hunt Road
Status: Closed
Abutting water: None

Closed when capacity was exhausted, part of the site was converted for use as part of parking lot for the adjacent truck stop. During operation primary use was disposal of municipal solid waste. It possibly also received some industrial and/or hazardous waste during the period it was in use. These wastes were not regulated. In combination with the Hunt Road facility, the site is the subject of an extensive hydrogeologic study of the movement of contaminated groundwater.

Site: Hunt Road
Location: Hunt Road west of Lone Tree Hill
Status: Inactive
Abutting water: Unnamed tributaries to Merrimack River.

Shut down as its capacity was exhausted, this site is the subject of extensive hydrogeologic study due to the contamination of groundwater between the site and Pleasant Valley Road. Site has been covered by an interim cap pending outcome of the hydrogeologic study. Initial reports indicate leachate may be passing under Merrimack River and contaminating areas south of the river. Like Titcum Pit, this was a commercial landfill receiving primarily municipal solid wastes, but may also have received industrial/hazardous waste as these wastes were unregulated for most of its operating life.

Andover

Site: Municipal Landfill?
Location: (assumed) Jct. of I93 and Chandler Road
Status: Abandoned
Abutting Water: None known

This is an old abandoned site for which the Department has no descriptive records.

Ashland

Site: Municipal Landfill
Location: Howe Street
Status: Closed
Abutting water: Indian Brook

Closed in accordance with approved plans, the site was last inspected in 1989. No known environmental problems are occurring at this site. At last inspection the site appeared to be in good condition.

Bedford

Site: Municipal Landfill
Location: Carlisle Road
Status: Inactive
Abutting water: Concord River

Closed prior to 1977, the Regional staff of the DSWM does not have knowledge of this facility.

Site: VA Hospital
Location: Springs Road
Status: Inactive
Abutting water: None

Primarily a demolition landfill, this site was used for disposal of materials from the hospital. The Department approved plans for the closure of this circa 1985. It is not known how the plans have been implemented.

Billerica

Site: Shaffer Landfill
Location: Pond Street
Status: Inactive
Abutting water: Middlesex Canal, Content Brook

Site is included in the Iron Horse Park Super Fund site. Closed to receipt of refuse in 1986, the site is now in the process of final closure. Primarily a disposal site for municipal solid wastes, it is believed small amounts of industrial solvents were disposed of in the landfill. Leachate from the landfill has been documented in Content Brook and Richardson Pond.

Burlington - no known landfills.

Carlisle

Site: Municipal Landfill
Location: Lowell Street
Status: Closed
Abutting water: Unnamed tributary to River Meadow Brook

An old landfill closed before much of a solid waste enforcement program, little is known about the site. Upon closure the site was converted to a transfer station from which the wastes are shipped out of town for disposal.

Chelmsford

Site: Municipal Landfill
Location: Swain Road
Status: Inactive
Abutting water: Scotty Hollow Brook

A small landfill for municipal solid wastes, the facility was closed to receipt of refuse in the early 1980's. The site is now being capped as part of the final closure of the facility. No environmental problems have been documented at the site.

Concord

Site: Municipal Landfill
Location: Jct. Routes 2 and 126
Status: Active
Abutting water: Goose Pond

Formerly an abandoned gravel pit, the site now operates as a sanitary landfill. The oldest portion of the landfill has been closed and capped off. The current operating part of the landfill has been constructed with a clay liner and leachate collection system.

Site: Hanscom Air Force Base
Location: Virginia Road
Status: Closed
Abutting water: Elm Brook

This site is one of at least two sites operated by the Air Force at Hanscom Air Force Base for the disposal of solid wastes. The site was formally closed circa 1987 under the 21E waste site cleanup project under way at the base. The second site (location not known to DSWM staff), is under investigation as part of the 21E investigation of the base.

Dracut

Site: Municipal Landfill
Location: Hildreth Street
Status: Abandoned
Abutting water: Unnamed tributary to Peppermint Brook

Closed due to poor operation, the site was noted for problems with contamination of Peppermint Brook.

Site: Municipal Stump Dump
Location: Hildreth Street
Status: Active
Abutting water: Unnamed tributary to Beaver Brook

This facility is not know to Regional DSWM staff.

Framingham

Site: Municipal Landfill
Location: Jct. I90 and Route 9
Status: Inactive
Abutting water: Unnamed tributary to Stony Brook

Closed to the receipt of refuse in 1985, the site was primarily a disposal site for ash from the Framingham Municipal Incinerator. During the down periods of the incinerator some raw municipal solid wastes were disposed of at the site. On closure to the receipt of wastes an interim cap of asphalt was placed on the top of the landfill. Currently a developer is developing plans to convert the site to an office park.

Site: Municipal Landfill
Location: Old Gates Road
Status: Abandoned
Abutting water:

An old ash landfill, little is known about the site.

Site: Municipal Landfill
Location: Dudley Road
Status: Abandoned
Abutting water: Eames Brook and Farm Pond

An old abandoned site, little is known about the site except that it was operated by the city for the disposal of municipal solid wastes.

Site: Millwood Street Landfill
Location: Millwood Street
Status: Abandoned
Abutting water: Birch Meadow Brook

Reported closed to receipt of refuse in 1968. This site is believed to have received municipal solid wastes, although little is known about the site.

Groveland

Site: Yemma
Location: Unknown
Status: Abandoned
Abutting water: Unknown

Recorded as a municipal sanitary waste landfill, the site is not shown in DSWM Regional records. It is believed to be near the Haverhill City line near Groveland Road.

Haverhill

Site: Municipal Landfill
Location: Groveland Road
Status: Active
Abutting water: Merrimack River and Johnson Creek

Declared a superfund site due to the documented disposal of hazardous wastes and proximity to the Groveland municipal water supply wells, the site was closed to the receipt of municipal solid wastes circa 1979-80. The site is currently used as a disposal site for beater waste from Haverhill Paperboard, and sludge from the Haverhill Municipal Water Treatment Plant. Monitoring wells have not shown major contamination of groundwater. However, wastes were disposed of right up to the edge of water of the Merrimack River. Subject to the ebb and flow of the tide, trash is visible at the waters edge below the high tide line.

Site: Ogden Martin
Location: Recovery Way, Ward Hill Industrial Park
Status: Active
Abutting water: Merrimack River

This is a new landfill established in 1979. The original cell was constructed with a clay liner. Since opening, the design has been continually upgraded so that current operating cells have a composite liner consisting of two feet of select compacted glacial till overlain by a 60 mil HDPE membrane. Leachate is treated and discharged to the Haverhill Municipal WWTF. The entire facility is underlain by a groundwater collection/control system that discharges to the Merrimack. Groundwater is continually monitored and no leaks have been detected. The site serves primarily as an ash disposal site for Ogden Martin's Resource Recovery Facilities, but also receives municipal solid wastes.

Lawrence

Site: Municipal Landfill
Location: Off Route 495
Status: Abandoned
Abutting water: Merrimack River

Reported closed in 1964, the site is now used as a transfer station to ship wastes out of town. The site primarily is believed to have served as a disposal site for the city's incinerator, but probably also received municipal solid wastes as well. Little else is known about the site.

Site: River Road
Location: River Road
Status: Abandoned
Abutting water: Merrimack River

This is an old abandoned site discovered during siting of the Emerson College relocation. Nothing is known about this site.

Lexington

Site: Municipal Landfill
Location: Hartwell Avenue
Status: Abandoned
Abutting water: Side branch to Kiln Brook, Tophet Swamp

Established in the early 1960's, the facility was closed to the receipt of refuse concurrent with the opening of the NESWC Resource Recovery Facility. The site is now used for recycling and may be still used in the disposal of yard wastes and street sweepings. It is not known whether the site was ever properly closed in accordance with the regulations.

Lowell

Site: Westford Street Landfill
Location: Westford Street
Status: Active
Abutting water: Black Brook

Currently active but nearing capacity, the landfill receives municipal solid wastes for disposal. Accusations have been made that toxic wastes were disposed of in the landfill, but these have never been documented. Circa 1978 the detection of the offsite migration of leachate resulted in the active area being capped with clay. Since that time landfilling has continued on top of the capped area. Leachate collected from the current active area is collected and treated on site. Up until 1989 the treated leachate has been discharged to groundwater adjacent to the landfill. Currently the treated leachate is discharged to the city of Lowell WWTF. The current active landfill occupies only about half the site. The balance of the site consists of an area of solid waste disposal that was abandoned in the 1960's. No attempt has been made to remediate contamination already moved offsite.

Site: Tanner Street
Location: Tanner Street
Status: Unknown
Abutting water: River Meadow Brook

Reported as a sanitary landfill, the site is unknown to Regional DSWM staff.

Site: Nesmith Street Municipal Landfill
Location: Nesmith Street
Status: Unknown
Abutting water: Unknown

Reported as a municipal sanitary landfill, this site is unknown to Regional DSWM staff.

Site: Chelmsford Street Municipal Landfill
Location: Chelmsford Street
Status: Unknown
Abutting water: Unknown

Reported as a municipal sanitary landfill, this site is unknown to Regional DSWM staff.

Site: Methuen Street Municipal Landfill
Location: Methuen Street
Status: Abandoned
Abutting water: None

Located on Methuen Street at the Dracut town line, little is known about this site. Reports have been heard about occasional attempts to develop the site, but the site is understood to remain abandoned.

Merrimac

Site: Battis Road Landfill
Location: Battis Road
Status: Active
Abutting water: Cobbler Brook

This small landfill for municipal solid wastes serves the community of Merrimac. While some problems with buffer zones between the landfill and abutments have occurred, no major environmental problems have been documented.

Site: Bearhill Road Stump Dump
Location: Bearhill Road
Status: Unknown
Abutting water: Black Brook

This municipal stump dump is reported as closed in 1979, but is unknown to Regional DSWM staff.

Site: Highland Road
Location: Highland Road
Status: Abandoned (assumed)
Abutting water: Unknown

This site reported as a municipal solid waste landfill is unknown to Regional DSWM staff.

Site: Broad Street Landfill
Location: Broad Street
Status: Abandoned (assumed)
Abutting water: Cobblers Brook

Reported as closed in 1979, this site is unknown to Regional DSWM staff. The site is believed to be located between Broad and North Streets just south of Route 495.

Methuen

Site: Huntington Avenue Municipal Landfill
Location: Huntington Avenue at New Hampshire state line
Status: Active
Abutting water: Wetlands tributary to World End Pond

This landfill is currently in active use by the town for disposal of municipal type solid waste from small commercial businesses in Methuen. It is expected to close within the next year as it is at capacity and the town's transfer station (located at the landfill site) is nearing completion. The landfill has been documented as a significant generator of leachate which flows into the wetlands west of the landfill and then northerly towards World End Pond in Salem, New Hampshire. Most of the leachate is captured and given some degree of treatment in a facultative lagoon at the southwest corner of the landfill. The lagoon is unlined and leachate flows unimpeded directly via groundwater from the lagoon to the wetlands. At this time no contamination of World End Pond has been documented.

Newburyport

Site: Corwan Landfill
Location: Unknown
Status: Abandoned (assumed)
Abutting water: Unknown

This site is reported as a private sanitary landfill, but is unknown to Regional DSWM staff.

North Andover

Site: Municipal Landfill
Location: Holt Road
Status: Abandoned
Abutting water: Merrimack River

Located adjacent to the NESWC Resource Recovery Facility, this former municipal landfill is now owned by the Commonwealth. The landfill received general urban waste until it was closed to establish the Resource Recovery Facility. Little is known about its impacts on the environment.

Sudbury

Site: Sand Hill Municipal Landfill
Location: Route 20
Status: Active
Abutting water: Wetlands tributary to Sudbury River

An active municipal solid waste landfill, this site has not been observed as adversely impacting the environment. Most of the site is an unlined landfill which has been covered by a low permeability cap pending a proposed future vertical expansion. Currently under construction is the last cell in the horizontal expansion of the landfilled area. This cell (about two acres) is being lined with a clay liner. Leachate collected from the lined area will be disposed of at the Wayland-Sudbury Regional Septage Disposal Facility adjacent to the site.

Site: Route 117 Municipal Landfill
Location: Unknown
Status: Unknown
Abutting water: Unknown

Reported as a municipal sanitary landfill closed in 1970, this site is unknown to Regional DSWM staff.

Site: Dakin Road Landfill
Location: Dakin Road
Status: Abandoned (assumed)
Abutting water: Unnamed tributary to Cold Brook

Reported as an active sanitary landfill, this site is unknown to Regional DSWM staff.

Tewksbury

Site: Rocco Landfill
Location: South Street
Status: Abandoned
Abutting water: Unnamed tributary to Shawsheen River

This landfill was closed in the late 70's by court order due to violations of wetlands regulations and failure to follow approved plans. Site was capped with a supposedly low permeability soil pending final closure, but even this cap was never maintained. Cap now has large cracks exposing refuse below. Wetland violations involving the disposal of ash, sludge and oily soils still occur at the site. Low concentrations of volatile organics have been measured in the air at the site and leachate has been observed entering the stream. Effects of the leachate on the stream has never been quantified.

Site: Martha Avenue Landfill
Location: Martha Avenue
Status: Abandoned (assumed)
Abutting water: Strong Water Brook

Reported as a municipal sanitary landfill, closed in 1957 this site is unknown to Regional DSWM staff.

Site: Pine Street Stump Dump
Location: Pine Street
Status: Unknown
Abutting water: Long Pond

Located at the town's DPW yard, this site is unfamiliar to Regional DSWM staff.

Site: Municipal Landfill
Location: South Street
Status: Abandoned
Abutting water: Unnamed tributary to Shawsheen River

No true documentation of the existence of site is known, however, it is reported as being just across the brook south of the Rocco landfill site. Little else is known.

Site: Sand Hill Municipal Landfill
Location: Route 20
Status: Active
Abutting water: Sudbury River

This active landfill receives municipal solid waste from the town of Wayland. Of the existing landfill 2/3 is closed and capped. The remaining 1/3 is lined and has a leachate collection system. Plans are now under review for the design of the liner for the remaining portion of the site (approximately 50% of the total ultimate area of the landfill).

Site: Corenco Landfill
Location: Woburn Street
Status: Unknown
Abutting water: Concord River

This private landfill has been used for the disposal of processing waste from the Corenco rendering plant. Listed here as Tewksbury, the facility could actually be in Billerica.

Corenco rendering plant. Listed here as Tewksbury, the facility could actually be in Billerica.

Tyngsborough

Site: Charles George Landfill
Location: Dunstable Road
Status: Closed, Federal Superfund Site
Abutting water: Flint Pond

This landfill is a Federal Superfund Site. In September of 1988 the EPA signed a Record of Decision outlining the remedial actions which would take place at and around the site. Cleanup, which began around December of 1988, includes capping of the landfill with an impermeable cover to prevent further leachate production. Eventually, leachate and contaminated groundwater will be collected and treated on-site, with a probable discharge to the ground.

Wayland

Site: Municipal Landfill
Location: Route 20
Status: Closed
Abutting water: Wash Brook

This old closed landfill was used for the disposal of municipal solid waste.

APPENDIX H
PRIORITY ONE HAZARDOUS WASTE SITES *

TOWN	SITE NAME	STATUS**
AMESBURY	OLD COLONY GAS STATION	PHASE 2-4
AMESBURY	MICROFAB. INC.	PHASE 2
AMESBURY	PROPERTY	PHASE II
ANDOVER	PROPERTY	PENDING
ANDOVER	G.S.F.	PHASE 1
ASHLAND	NYANZA, INC.	PHASE 3
ASHLAND	TRIMOUNT BIT. PRODUCTS	PHASE 2-3
ASHLAND	CADILLAC PAINT	PHASE 2
BEDFORD	MITRE	PHASE 3
BEDFORD	MOBIL SERVICE STATION	PHASE 4
BEDFORD	FORMER SERVICE STATION	PHASE 2
BEDFORD	RAYTHEON MISSILE SYSTEMS DIVISION	PHASE 2
BEDFORD	JOHN AITKEN CO.	PENDING
BEDFORD	USAF/HANSCOM FIELD	PHASE 2-4
BILLERICA	FORMER GAS STATION	PENDING
BILLERICA	IRON HORSE PARK	PHASE 2
BILLERICA	CAPORALE SITE	PHASE 2
BILLERICA	GENERAL LATEX & CHEMICAL CORP.	PHASE 2
BILLERICA	MOBIL SERVICE STATION	PENDING
BURLINGTON	RECOGNITION EQUIPMENT	PENDING
BURLINGTON	ALTO-TRONICS CORPORATION	PHASE 2
BURLINGTON	MICROWAVE ASSOCIATES	PHASE 4
BURLINGTON	RCA CORP.	PHASE 2
BURLINGTON	VINE BROOK AQUIFER	PHASE 1-4
BURLINGTON	JERGUSON GAGE & VALVE	PENDING
BURLINGTON	U.S. WINDPOWER INC.	PHASE 2
BURLINGTON	R.J.KELLY	PHASE 3
CARLISLE	OLD FIRE STATION	PHASE 3
CHELMSFORD	CHELMSFORD AQUIFIER STUDIES	PHASE I
CHELMSFORD	TEXACO STATION	PENDING
CHELMSFORD	CHEVRON STATION 118723	PENDING
CONCORD	FORMER HAYES PUMP SITE	PENDING
CONCORD	PATRIOT AMBULANCE	PENDING
CONCORD	NUCLEAR METALS INC.	PHASE 2
CONCORD	GULF STATION	INACTIVE
DRACUT	ATLANTIC COREY	
DRACUT	BAYSTATE EQUIPMENT	PENDING
DRACUT	TOUPIN BROTHERS RIGGING	PHASE 1
DRACUT	PRIVATE RESIDENCES	PHASE 1
DRACUT	EXXON OIL TERMINAL STORAGE	PHASE 1
FRAMINGHAM	AUTO BRITE CAR WASH	PHASE 2
FRAMINGHAM	FENWAL ELECTRONICS	PENDING
FRAMINGHAM	"FORMER LUDLOW CORP."	PENDING
FRAMINGHAM	CROWN DEALERSHIP	PENDING
FRAMINGHAM	COMMONWEALTH GAS	PHASE 3-4
FRAMINGHAM	INDUSTRIAL PARK	PENDING
FRAMINGHAM	DELITIZER RESTAURANT	PHASE 4
GROVELAND	VALLEY MANUFACTURERS	PHASE 3-4
GROVELAND	GROVELAND WELLS (EPA)	PHASE 2-3
HAVERHILL	HAVERHILL LANDFILL (EPA)	PHASE 2
HAVERHILL	HAVERHILL SALVAGE YARD	PHASE 1
HAVERHILL	OLD FERRY RD SITE	PENDING
LAWRENCE	PROPERTIES	PENDING
LAWRENCE	NATIONAL NORTHEAST CORP.	PHASE 2
LAWRENCE	TOWER HILL	PHASE 2
LAWRENCE	DIVERSITECH GENERAL	INACTIVE
LAWRENCE	BKC INTERNATIONAL ELECTRONICS	PENDING
LEXINGTON	PROPERTY	INACTIVE

LEXINGTON	MIT LABORATORY	PENDING
LEXINGTON	RAYTHEON	PENDING
LEXINGTON	PROPERTY	PENDING
LINCOLN	EXECUTIVE FLYERS AVIATION	PHASE 4
LOWELL	MACHERAS SERVICE MART	PHASE 1
LOWELL		PENDING
LOWELL		PENDING
LOWELL	COLONIAL GAS CO.	PHASE 2
LOWELL	GAS STATION	INACTIVE
LOWELL	COMMONWEALTH CHEM CORP.	PHASE 3
LOWELL	GAS STATION	PENDING
LOWELL		PENDING
LOWELL	SILRESIM CHEMICAL CORP.	PHASE 2-3
LOWELL		PENDING
LOWELL	PROPERTY	PHASE 3
LOWELL	CITGO STATION	PENDING
METHUEN	GULF SERVICE STATION	
NATICK	SHELL OIL	PENDING
NATICK	OLD COLONY GAS STATION	PHASE 2-4
NATICK	FORMER AMOCO #409	PENDING
NORTH ANDOVER	AT & T	PHASE 2
NORTH ANDOVER	EXXON STATION	PENDING
SUDBURY	COATINGS ENGINEERING CORP.	PHASE 2
SUDBURY	UNDEVELOPED LAND	PHASE 2
TEWKSBURY	RTE.38 (MAIN ST.) GASOLINE LEAK	PHASE 1
TEWKSBURY	GETTY STATION	PENDING
TEWKSBURY	GREAT SWAMP PHENOL	PHASE 1
TEWKSBURY	SHELL STATION	PENDING
WAYLAND	SCHICK FARM/WATERTOWN DAIRY	PHASE 2
WILMINGTON	FRED'S SERVICE STATION	PENDING
WILMINGTON	RITTER TRUCKING	PHASE 3
WILMINGTON	JIMMY'S GAS STATION	PENDING
WILMINGTON	PROPERTY	PENDING

*From the DEP Northeast Regional Office Database. Current as of 12-15-88.

**Phase 1 through phase 5 refers to progressive elements of an investigation/remediation process, as defined by the DEP.

Appendix I

Merrimack Valley Initiative Inspections-Alphabetic by Company Name

<u>City/Town</u>	<u>Inspection Date/Type</u>	<u>Company Name/Address/MAD # /Insp. Notes</u>
No. Andover	7/18/89 LQG(I)	AT & T Technologies, 1069, 1600 Osgood St. MAD 001 005 370
Amesbury	10/15/88 LQG(I)	Adams Russell Co., Inc.,874, MAD 099 187 197
	3/20/89 LQG(F)	Adams Russell Co., Inc.,963
Haverhill	11/10/88 LQG(I)	Alternate Circuit Technology,873, 46 Rogers Rd.,
	5/1/89 (F)	Alternate Circuit Technology,988 MAD 981 067 234
Methuen	3/3/89 LQG(I)	Alpha Industries,940, 651 Lowell St., MAD 981 063 886
Lawrence	7/21/88 LQG	Andrew Wilson Co., 616 Essex St., Chapter 11, MAD 001 013 721
Methuen	1/18/89 SQG(I)	Andrew's Service Station, 974, 2 Lowell St.,
	6/30/89 (F)	Andrew's Service Station, 1048 MAD 019 486 562
Chelmsford	5/17/89 SQG(I)	Antons Cleaners,995, E.Gate Plaza., Chelmsford St. MAD 980 733 240
Georgetown	6/30/89 SQG(I)	BME Eng.,1050, Carlton Ave., MAD 985 269 844
Lowell	5/10/89 LQG(I)	Bradford Industries,992, 75 Rogers St., MAD 893 543 357
Andover	5/3/89 LQG(I)	BTL Specialty Resins, 985, 77 Lowell Junction Rd. MAD 001 000 165
Newburyport	2/6/89 LQG(I)	Brush Wellman, Inc.,930, Newburyport Industrial Park, MAD 022 960 413
	3/31/89 LQG(F)	Brush Wellman, Inc.,1067, Newburyport Industrial Park, MAD 022 960 413

Lawrence	1/13/89	SGG	Carter's Auto Body, 916, 416 Broadway St., MAD 985 267 707
No.Andover	5/12/89	LQG	Century Laminators, Inc.,994, 60 Willow St., MAD 121 005 946
No.Andover	5/24/89	LQG	Chemineer Inc.,Kenics Div.,1016, 125 Flagship Dr. MAD 000 844 290
Newburyport	5/10/89 5/10/9	TSD/SGG sampling	Circle Finishing, 991, Rte. 1 Traffic Circle Circle Finishing, 1057 MAD 047 070 305
Lowell	1/23/89	LQG(I)	Circuit Service, Inc.,921,1995 Middlesex St., MAD 058 880 212
Lowell	5/15/89	LQG(I)	Coastal Carton, 998, 164 Meadowcroft St., MAD 001 005 990
Methuen	10/18/88 6/19/89	LQG(I) (F)	Commercial Truck Leasing,884, Hampshire Rd., Soil. Tank Removal, 21E, MAD 019, 424 550 Commercial Truck Leasing,1032
Dracut	11/3/88 5/1/89	LQG(I) (F)	Congress Technical Spray,875, 401 Broadway Rd. Congress Technical Spray,989 MAD 065 166 647
Amesbury	11/2/88 3/20/89	LQG(I) LQG(F)	Craig Systems,861, 10 Industrial Way, Craig Systems,964 MAD 980 971 747
Haverhill	3/30/89	LQG(I)	Crescent Circuits,978, 17 Locust St., ENFORCEMENT CASE
Lawrence	12/28/88	LQG(I)	Crown Cork & Seal Co., Inc.,893, 155 Sheppard St., MAD 049 432 008
Andover	6/29/89	LQG(I)	Digital Equipment Tech.,1043, 100 Minuteman Rd., MAD 000 652 271

Andover	6/29/89	LQG(I)	Dynamics Research Co.,1044, 60 Frontage Rd., MAD 981 203 656
Lowell	2/15/89	LQG(I)	Electro Circuits,934, 176 Walker St., MAD 001 008 770
Newburyport	3/30/89	LQG	Electronic Products,977, 85 Parker St., MAD 980 913 370
Andover	3/28/89	SGG	Elm St. Automotive,960, 15 Elm St.,
Methuen	3/31/89	LQG	Express 10 Minute Lube, 961, 488 Broadway MAD 985 269 372 waste oil only
Newburyport	11/16/88 3/30/89	LQG(I) LQG(F)	Foileark, 5 Malcolm Hoyt Dr.,876, MAD 981 074 875 Foileark, 5 Malcolm Hoyt Dr,1068, MAD 981 074 875
Lawrence	12/7/88	LQG	Frank C. Meyer Co., 906, 585 S. Union St., MAD 001 032 408
Methuen	11/29/88	SGG(F)	Fox-Nissan Pontiac,905, 145 Pelham St., Methuen MAD 011 821 816
Salisbury	7/15/88 4/14/89	VSGG NN	Gallagher's Furniture,841, Rte. 1 Bridge Rd., Gallagher's Furniture,973 ENFORCEMENT CASE
Andover	1/27/89	LQG	GCA/Burlington Division,920, 7 Shattuck Rd. MAD 991 130 837
Andover	7/20/89	LQG	Genetics Institute,1076, 1 Burit Rd. MAD 982 196 172
Andover	4/26/89	LQG	Gillette Co.,Inc., 30 Burit Rd.,984 MAD 053 483 467
Newburyport	2/1/89 7/12/89	LQG(I) LQG(F)	Gould Inc.-Circuit Protection Div.,927, 374 Merrimack St., MAD 001 014 174 Gould Inc.-Circuit Protection Div.,1064 374 Merrimack St., MAD 001 014 174

Andover	5/24/88	VSGG	Greater Lawrence H.S., 824
Dracut	12/28/88	VSGG(I)	Gringeri Bros. Inc., 894, 110 Loon Hill Rd.,
Andover	6/9/89	LOG(I)	Hewlett Packard Co., 1025, 3000 Minuteman Rd., MAD 086 534 864
Lawrence	2/14/89	LOG(I)	Honeywell Bull, 936, 250 Merrimack St., MAD 062 161 260
Andover	6/28/89	LOG(I)	IRS Andover Svc. Cntr., 1040, 310 Lowell St., MAD 071 716 682
Lawrence	2/14/89	LOG(I)	ITT Semiconductor, 935, 470 Broadway, MAD 088 976 923
Lowell	1/1/89 4/26/89	LOG(I) (F)	Ideal Tape Co., 913, 1400 Middlesex St., Ideal Tape Co., 980 MAD 056 019 979
Lowell	5/11/88	TSD(I)	Jet Line Of Lowell, 820, Howard St. MAD 047 075 734
Haverhill	4/8/88	LOG(I)	Jiffy Lube, 832, 25 Plaistow Rd, MAD 982 196 719
Haverhill	6/13/88	LOG(F)	Jiffy Lube, 917
Lawrence	12/21/88	LOG(I)	Longhorn Mobil, 907, 266 Broadway, MAD 101 182 392
Lowell	10/31/88	SOG(I)	Kazanians Auto Repair, 854, 256 Smith St. MAD 981 888 100
Newburyport	2/2/89	LOG(I)	M & V Electroplating, 928, 5 Greenleaf St., MAD 001 042 647
	3/31/89	LOG(F)	M & V Electroplating, 1070, 5 Greenleaf St., MAD 001 042 647
Lowell	4/27/89	LOG(I)	MA/COM Advanced Semiconductors, 981, 100 Chelmsford St. MAD 980 672 398

Lowell	7/26/89	LQG(I)	Majillite Corporation, 1084, 100 Whipple St. MAD 058 889 031
Lawrence	3/15/89	LQG(I)	Malden Mills, 956, 46 Stafford St., MAD 001 030 376
No. Andover	1/27/89	LQG(I)	Mass. Electric, 919, 1101 Turnpike St., MAD 030 833 966
Newburyport	3/31/89	LQG(I)	Mass. Electric, 976, 78 Water St., MAD 980 731 582 In Compliance
Methuen	5/17/89	LQG(I)	Mass Electric, 1014, Pelham Ave., MAD 980 731 772
Amesbury	3/24/88 6/29/88	LQG(I) (F)	Microfab, 811, Haverhill St., MAD 001 409 408
Lowell	10/17/88	LQG(I)	Microwave Printed Circuitry, 857, 81 Old Ferry Dr. MAD 047 648 829
Lowell	6/20/89	LQG(I)	Multi-Core, Inc., 1029, 100 Hale St., MAD 985 272 871
Lawrence	11/15/88	LQG(I)	Multi Lab, Inc., 904, 37 Manchester St., MAD 980 523 344
Lawrence	3/3/89	LQG(I)	National Northeast Corp., 945, 65 Manchester St. MAD 056 001 688
Lowell	11/3/88 5/1/89	LQG(I) (F)	North American Directory, 862, 17 Hall St., North American Directory, 990 MAD 991 289 273
Lawrence	4/12/88/	T	Northeast Solvents Rec., 816, 300 Canal St., MAD 000 604 447 In Compliance
Lawrence	4/12/88	TSD(I,F)	Northeast Solvents Rec., 815, 300 Canal St., In Compliance

Lawrence	3/31/89	TSD(I,F)	Northeast Solvents Rec., 1008 MAD 000 604 447 In Compliance
Chelmsford	11/10/88	LQG(I)	Nyes Japanamelac, 882, 25 Katrina Rd., MAD 001 040 175
Newburyport	2/3/89	LQG(I)	Owens-Brockway(Illinois)Plastic Products, 929, Parker St., MAD 001 038 967
	6/19/89	LQG(F)	Owens-Brockway(Illinois)Plastic Products, 1071, Parker St., MAD 001 038 967
Chelmsford	5/17/89	NN(I)	Packaging Corp. of America, 1053, 33 Glenn Ave.,
Haverhill	5/9/89	SGG(I)	Paradis Garage, 993, 2 Cross Rd., MAP 000 018 426
Lawrence	1/13/89	SGG(I)	Pellerini Auto Body, 915, 114 Marston St., MAD 981 208 275
Newburyport	1/1/89	LQG(I)	Polyonics, 910, 112 Parker St., MAD 980 672 141
Newburyport	1/11/89	LQG(I)	Polyonics, 911, 24 Graf Rd., MAD 061 186 201
	6/19/89	LQG(F)	Polyonics, 1072, 24 Graf Rd., MAD 061 186 201
Haverhill	4/4/89	LQG(I)	Printed Circuit Design, 966, 17 Locust St., MAD 985 266 154
Andover	6/13/89	LQG(I)	Raytheon Co., 1026, 350 Lowell St., MAD 001 055 235
Andover	6/13/89	LQG(I)	Raytheon Co., 1027, 358 Lowell St., MAD 980 913 172
Haverhill	3/8/89	NN(I)	Roberts Auto Parts, 948, 379 Kencza St.,
Methuen	3/31/89	LQG(I)	Rick's Motorcycle Supply, 962, 9 Pine St., MAD 981 889 738
Lowell	6/30/88	LQG(I)	Roche Bros. Barrel & Drum Co., 848, 161 Phoenix Ave., MAD 001 035 971

Haverhill	6/27/88	VSGG	Royal Limosine, 828, 99 Newark St., MAP000 030 920
Salisbury	6/8/88	TSD(I)	Safety Kleen, 939, 189 A-Willow St., MAD 060 095 569
Salisbury	2/15/89	TSD(I)	Safety Kleen, 937, 189 A Willow St., MAD 060 095 569
Amesbury	2/29/88	SGG(I) NN	Sagamore Industrial Finish Corp., 810, Rocky Hill Rd., Non Notifier
No. Andover	10/14/88	LQG	Service Chemical, 855, 221 Sutton St., MAD 001 055 805 In Compliance
Amesbury	2/11/88	T	Suffolk Services, 804, Tanner St. MAD 049 440 951
Lawrence	1/24/89	LQG(I)	Technical Systems and Design, 918, 15 Union St., MAD 106 772 742
Lowell	12/13/88	LQG	Textron Specialty Materials, 889, 2 Industrial Ave., MAD 097 437 982 In Compliance
Lowell	12/22/88	LQG	Textron Specialty Materials, 892, 1449 Middlesex St., MAD 000 639 054 In Compliance
Boxford	6/30/89	NN	Twin Home Realty, 396 Ipswich Rd., Non Waste Generator
Salisbury	8/23/88	SGG(I)	Vaughn Mfg., 845, 386 Elm St., MAD 001 003 466
Salisbury	3/7/89	SGG(F)	Vaughn Mfg., 941, 386 Elm St., MAD 001 003 466
Lowell	11/29/88	LQG(I)	Vulkor, Inc., 883, 950 Broadway, MAD 001 408 475
	6/5/89	(F)	Vulkor, Inc., 1023

Lowell	5/15/89	LGG	Wang Laboratories, 997, 1001 Pawtucket Blvd. MAD 980 522 783 In Compliance
Lowell	5/16/89	LGG	Wang Laboratories, 999, 11 Industrial Ave., MAD 000 636 316 In Compliance
Methuen	6/14/89	LGG(I)	Wang Laboratories, 1028, 126 Merrimac St., MAD 000 844 571
Haverhill	5/19/88	VSGG	Whittier Vocational H.S., 822

APPENDIX I

Sampling of items checked during large quantity generator inspection:

- Legal Disposal
- Manifest Discrepancies
- Condition of Container
- Compatibility of Waste with Container
- Marking of Container
- Labelling of Container
- Managing Container
- Inspecting Container
- Spill Containment

- Accumulation Area Marking
- Accumulating Area Delineation
- Accumulation Area Security
- Emergency Phone Number List Posted

- Employee Training (formal)
- Contingency Plan (formal)
- Notification to Local Authorities
- Notification to Local Hospitals
- 90 Day Waste Accumulation Limit
- Annual Report of Waste Generation

APPENDIX I (continued)

TYPES

VSQG*	Those companies which generate less than 25 gallons of hazardous waste (approx.) per month.
SQG	Those companies which generate more than 25 gallons but less than 250 gallons of hazardous waste per month.
LQG	Those companies which generate more than 250 gallons of hazardous waste per month.
TSD FACILITY	Companies which treat, store, or have on site disposal of hazardous waste. Massachusetts presently has no facilities licensed for disposal. TSD facilities may also "generate" hazardous waste, and are usually licensed to "transport."
TRANSPORTER	A company licensed to transport hazardous waste in Massachusetts. Full compliance inspections are not performed at Transporters whose home base is outside of Massachusetts. "Audits," however, are periodically conducted, when an out-of-state transporter is observed at a Massachusetts TSD facility.
NON NOTIFIERS	Those companies which generate hazardous waste, and actually fall into one of the above waste generation categories, but have failed to register or notify and obtain an I.D. number. These companies are usually identified by anonymous or worker complaints. Inspections of these facilities may result in a Notice of Noncompliance, or criminal/civil penalties for illegal storage or disposal.
WASTE OIL GENERATORS*	These companies generate waste oil only, which is regulated as a hazardous waste on the state level only.

* State classification

